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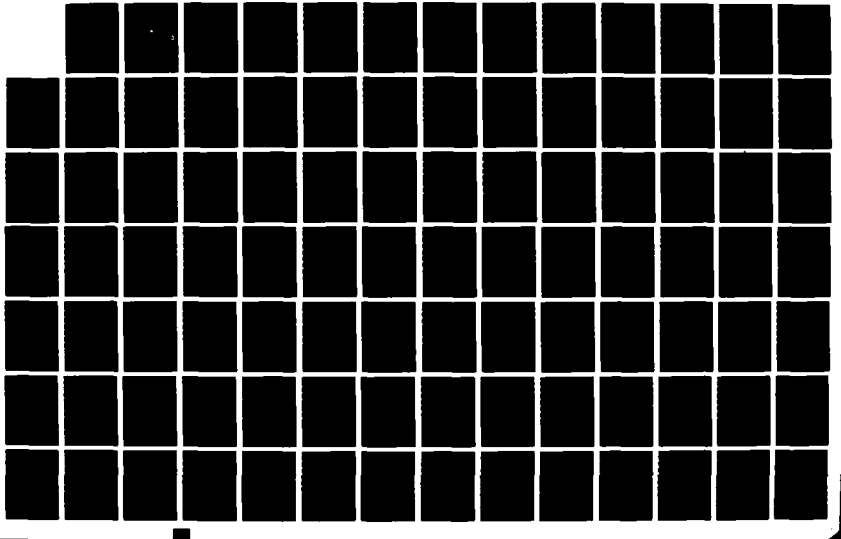

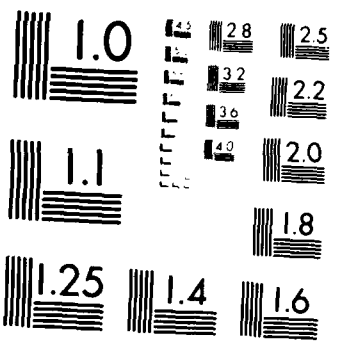

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Monterey, California

THESIS

DEPARTMENT OF DEFENSE EXPENDITURE IMPACT ON STATE ECONOMIC GROWTH

by

Craig E. James

December 1987

Thesis Co-Advisors: Stephen Mehay
Loren Solnick

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Department Of Defense Expenditure Impact on State Economic Growth

by

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Submitted in partial fulfillment of the requirements for the degree of

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ABSTRACT

Utilizing pooled cross-sectional and time series data an econometric model is used to estimate the impact defense expenditures had on state economic growth between 1976 and 1985. Defense contracts for procurement, research and development, services, and construction were found to have a significant positive effect on state growth during this period. However, defense expenditures for civilian payrolls were found to have had a significant adverse effect on growth and expenditures on military payrolls were found to be insignificantly related to state growth.

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I. INTRODUCTION

A. DEFENSE SPENDING AND REGIONAL GROWTH

Defense spending in the United States is often considered the classic example of a public good. The government takes funds from the private sector via taxation and provides a national defense. Expenditures for defense are not usually considered a policy tool for encouraging economic growth. On this subject one study found that during the 1970's defense expenditures have slowed the economic performance of the United States compared to other western industrialized nations [Ref. 1:p. 41].

The Pentagon is the largest single purchaser of goods and services in the economy [Ref. 2:p. 11]. Defense purchases differ from transfer payments, the other major category of federal expenditure. Transfer payments typically go to anyone who qualifies and even though there are patterns of transfers among the states their impact is relatively geographically diffused. In contrast, defense expenditures directly affect a specific area where a military base is located or a contract awarded. So, while providing a public good national defense also has an incidental effect on individual state economies.

The Commerce Department recently cited defense expenditures as one of the contributing factors in the reversal of a trend toward reduced differentials in regional

per capita income. Up until 1979 there had been a trend towards equalization in per capita income among regions. The Southeast region of the United States was the only region more than 5 percent below the national average with a per capita income 15 percent below the average. In 1979 the differences in per capita income between the richest and poorest regions were the smallest since 1929, when the government began keeping income statistics. [Ref. 3]

By 1986 this 50 year trend had reversed. The Southeast, Rocky Mountain, and Southwest regions all had per capita incomes 10 percent or more below the national average. Additionally, for the first time ever, the Great Lakes region had fallen below the national average. Meanwhile New England and the Far-West regions have seen their per capita incomes continue to increase. [Ref. 3]

Defense spending was only one of the causes cited by the Commerce Department in the increased regional differences in economic growth. Decline of the traditional smokestack industries, energy production and farming in the Central and Southern portions of the United States, as well as coastal area growth in high technology and service industries, also contributed. But given that defense expenditures help some regions grow faster than others, the incidental impact of those expenditures on regional and state economies should not be considered unimportant. This study examines defense expenditures for individual states over the last decade and

analyzes the significance of those expenditures on state economic growth.

B. SCOPE AND METHODOLOGY

To analyze the impact of defense expenditures a statistical model of state economic growth was constructed. Pooled time series and cross-sectional data over a ten year period from 1976 to 1985 were examined. Personal income for the 48 contiguous United States was used as a measure of state economic growth. Federal expenditures for defense, and individual state characteristics are used as explanatory variables in the growth model. State characteristics include expenditures, taxes, business climate and geographic variables.

This thesis is an extension of a thesis completed in June 1987 by LT Brian Finch titled THE EFFECT OF DEFENSE SPENDING ON STATE ECONOMIC GROWTH. Finch used two methods of analysis to examine defense expenditure impacts; an interstate export model and a statistical analysis similar to the one done in this thesis. He found that total defense procurement dollars did have a positive and significant effect on total personal income. [Ref. 4:p. 47] Other findings from that thesis are presented in Chapter III.

This thesis looks at economic growth both on a total personal income basis (the same approach used in LT Finch's model) and on a per capita income basis. The time period analyzed is expanded from six to ten years and additional

explanatory variables are introduced into the growth model. Most importantly, defense expenditures are broken up into procurement contracts, service contracts and construction contracts. Also, additional defense expenditure explanatory variables for research and development contracts, military payrolls and civilian payrolls are included in this model.

C. SUMMARY OF FINDINGS

Two variations of the same growth model were used to analyze the impact of defense expenditures on state growth. The first used total personal income as a proxy for volume growth of state economies. The second used per capita personal income as a proxy for welfare growth of state economies.

In the volume growth variant of the model all four categories of defense contracts had a significant positive effect on state growth. These categories of contracts were procurement, research and development, services, and construction. Surprisingly, payrolls for civilian employees of the Department of Defense were found to have a significant adverse effect on state growth. Military payrolls also had a negative effect on growth, but the relationship was statistically insignificant.

The second model tested the impact of defense spending on welfare growth as measured by growth in per capita income and showed somewhat different results. All defense expenditures for payrolls and contracts were found to have a positive

influence on state growth, but only procurement contracts and research and development contracts were statistically significant. These results are discussed in depth in Chapter V.

D. ORGANIZATION OF STUDY

The next chapter describes defense spending. Different categories of expenditures and their effects are discussed. Additionally, the impact these various types of expenditures would be expected to have on state economic growth is presented.

Chapter III reviews the literature on regional growth and develops the theoretical framework for the study. Several econometric study results are discussed and evaluated. The measures of economic growth of a region or a state are discussed, as well as specific factors expected to influence growth.

Chapter IV presents the statistical methods and model used in this study. The independent variables used in the study, and their reason for inclusion in the model, are discussed. Sources for the data and some known shortcomings are listed.

Chapter V presents the analysis of the data. Possible causal relationships between the results and the real world are discussed. Statistical problems inherent in the model and methods used are described.

Chapter VI is a summary of the study. Conclusions and recommendations for further research are presented.

II. DEFENSE EXPENDITURES

A. INTRODUCTION

The previous chapter referred to defense expenditure impacts on state economies as incidental to the purpose of the expenditures. This does not mean that the impacts are unimportant or unintended. The Congressional authorization and appropriation process that decides how and where defense dollars are spent assures proper political consideration of defense spending impacts.

Why is this political consideration important? Many members of Congress feel that defense expenditures can be used as a tool for remedying economic problems within specific areas [Ref. 5:p. 154]. In these members' minds, contract awards should include not only price and performance considerations, but also state and region studies of employment, with award preference given to declining or stagnant regions. This attitude cause defense planners to be conscious of the political realities of defense expenditures and aware of the economic impact these expenditures have on a state's or region's economy. Specifically, defense expenditures will have direct, indirect and induced impacts on a state's economy [Ref. 6:pp. 79-83].

B. IMPACTS OF EXPENDITURES

Direct impacts are the most visible and easily measured of the three types of economic impacts on an economy. Frequently, when a politician is considering what a defense contract will do for his district direct impacts are the only type discussed. These impacts are equal to the initial dollars spent on defense within a state, and the magnitude of these impacts can be measured by the size of the expenditure. Any expenditure in a state by a DOD installation will exert a direct impact on the economy of that state. Additionally, any defense contract for goods or services within a state exerts a direct impact. For instance, in 1985 defense expenditures (or the direct impact for service contracts) in Ohio were $396 billion [Ref. 7]. This is by no means the sum total of the economic impacts of these service contracts on Ohio. To measure the total effect of defense spending other kinds of impacts must be considered.

When direct expenditures are made the producer of the goods and services must in turn buy goods and services from other businesses, and employ additional labor, as inputs to their own product. The employment of these resources produce a ripple effect in the state economy as the seller of the equipment must also buy goods, services and labor in order to provide that equipment. So the direct impacts result in indirect impacts on the state economy.

The magnitude of the indirect impacts will continue to diminish with each iteration or ripple as expenditures fan out in the state's economy. While these dollar magnitudes diminish, the sum of all the indirect impacts may be very significant and must be taken into account when considering total defense spending impact on a state. Data Resources Incorporated estimated total direct and indirect defense spending in dollars for each state in 1981 [Ref. 8:p. 3]. Table 1 is a summary of their findings.

There are two problems when measuring the indirect impact of defense spending on a state. One problem is that each successive round of expenditures within a state's economy is subject to leakage of expenditures to other states. This is due to the fact that states have open economies, unlike the national economy. In the national economy, excepting foreign imports, adding all of the indirect expenditures will result in the total indirect impact on the nation. Import quantities into the United States are relatively easy to determine. But, since a state has open borders, some of the inputs used in production will come from outside the state making quantities involved difficult to determine. In measuring the indirect impacts only the expenditures inside a state should be totalled. This means that for a state the sum of all inputs does not necessarily constitute the indirect impact of a direct expenditure.

TABLE 1

DIRECT AND INDIRECT COMPONENTS OF DEFENSE SPENDING IN 1981
(billions of dollars)

State	Direct	Indirect	Total
Alabama	2.2	2.4	4.6
Arizona	0.9	0.3	1.2
Arkansas	0.8	1.3	2.1
California	25.5	17.5	42.9
Colorado	2.3	2.3	4.6
Connecticut	4.2	2.9	7.1
Delaware	0.4	0.4	0.8
Florida	6.6	5.6	12.2
Georgia	3.6	3.3	6.9
Idaho	0.3	.4	.7
Illinois	3.3	8.2	11.5
Indiana	2.7	4.5	7.1
Iowa	0.6	1.6	2.2
Kansas	1.9	2.2	4.1
Kentucky	1.4	2.0	3.4
Louisiana	2.6	4.4	7.0
Maine	0.7	0.6	1.3
Maryland	3.8	2.4	6.2
Massachusetts	3.9	4.1	8.0
Michigan	1.9	5.7	7.6
Minnesota	1.3	2.6	3.9
Mississippi	1.7	1.3	3.0
Missouri	4.0	3.1	7.1
Montana	0.2	0.5	0.7
Nebraska	0.8	0.8	1.6
Nevada	0.5	0.5	1.0
New Hampshire	0.7	0.6	1.3
New Jersey	2.8	5.2	8.0
New Mexico	1.1	0.8	1.9
New York	7.2	11.1	18.3
North Carolina	2.8	3.7	6.6
North Dakota	0.4	0.3	0.8
Ohio	3.7	8.2	11.9
Oklahoma	2.0	2.8	4.8
Oregon	0.5	1.5	2.0
Pennsylvania	4.1	8.6	12.7
Rhode Island	0.5	0.7	1.1
South Carolina	2.2	1.9	4.1
South Dakota	0.3	0.3	0.6
Tennessee	1.2	2.9	4.1
Texas	10.9	14.7	25.7
Utah	1.0	0.9	1.9
Vermont	0.5	0.3	0.8
Virginia	8.7	3.1	11.8
Washington	4.1	3.2	7.3
West Virginia	0.2	1.3	1.5
Wisconsin	0.8	3.0	3.8
Wyoming	0.2	0.6	0.8

(Source: Data Resources Inc. [Ref. 8])

Subcontracting defense work causes a second problem in measuring indirect impacts. When a subcontract goes outside the state where the original prime contract was awarded, the total indirect impact on a state is less than when it is awarded within the state. Additionally, in the other state where the subcontract work takes place the dollars spent are effectively direct impacts on that state. These subcontracts will then generate their own indirect impacts on that state.

These two problems in measuring indirect impacts will not be considered in this thesis. It will be assumed that all expenditures remain within the state where the direct expenditure occurred. These two problems have different effects overall. Production inputs coming from outside the state will tend to diffuse defense dollars, spreading them out over several states. However, studies of subcontracting indicate that the geographic distribution of subcontracts are even more concentrated in particular states then DOD prime contracts. One 1968 study found that the top ten states for prime contracts had 61.3 percent of the total contract value [Ref. 10]. The same ten states had 76.4 percent of the subcontract value over the same period. Another study conducted six years later found basically the same results. The leading ten states in subcontracts received three-fourths of the awards, while the top ten in prime contracts received two-thirds. California and New York alone accounted for two-fifths of the total value of subcontract awards

[Ref. 2:p. 116]. In 1979 the same type of analysis found seventy-five percent of the subcontracts were performed in only ten states [Ref. 1: p. 10].

One other type of impact must be considered in measuring the total effect of defense expenditures on a state. These are the induced impact of payrolls. Employees of firms receiving direct and indirect expenditures are paid an income. This income is then used to purchase consumer goods and services within the state. The magnitude of induced impacts depends on the size of the payroll, the labor intensity of the industry receiving the direct and indirect expenditures, and the consumption functions of local households, which determines their propensity to consume within the state where they work [Ref. 6:p. 81].

Frequently, indirect and induced impacts are referred to as the multiplier effects of the direct expenditures. A state with a multiplier of two would expect to see a million dollars of direct expenditures have an additional impact of two million dollars on the state's economy. The total of the three impacts, direct, indirect, and induced will be the ultimate effect of defense spending on a state.

When considering defense spending it is also important to differentiate the type of expenditures. Three categories of expenditures will be analyzed: military payroll, civilian payroll and defense contracts. Each of these three categories have different indirect and induced impacts and

for that reason should be considered separately when discussing defense expenditure effects.

Civilian payroll is composed of the wages paid to civilian employees of the Department of Defense. The direct impact is measured by the size of the payroll itself. There are no indirect impacts of this type of expenditure. The induced impacts will be the additional demand caused by the employees' expenditures within a state. It includes multiplier effects of their consumption, new housing investment, private investment and public goods consumption and investment [Ref. 5: p. 157].

Military payroll is considered separate from civilian payroll. While the direct impact on a state is still the size of the payroll, the induced effects are expected to be substantially different. Military families typically have access to separate exchange and commissary facilities, which provide consumption goods often purchased outside the state. They also are provided services such as medical and dental care, recreation facilities, and military base housing. From the public sector standpoint military personnel often pay state income taxes outside the state where they are residing. The expected result is induced impacts of military payrolls on a state being significantly smaller than that of civilian payrolls. [Ref. 5: p. 169]

Contract expenditures will have all three of the impacts discussed. The direct impact will be the contracted cost of

the procured item. The indirect impacts are the purchases from all firms producing and selling inputs to the final producers. The induced impacts are the employee payrolls plus profits of owners of all firms receiving direct or indirect impacts and have the same induced effect on a state as DOD civilian payrolls. [Ref. 5:p. 157]

There seem to be few in depth studies looking at the effect of a new defense defense contract on a region. The tendency is to treat the impact the same as an increase in basic civilian industries. The multiplier effect in a specific region causes the same increase independent of whether it was a defense or a civilian induced expansion. However, one study of Wichita, Kansas provides an indication that this assumption is incorrect.

Typically, for every 100 employees added to its basic manufacturing companies, Wichita has experienced an increase in the local work force of 150 employees. Wichita, therefore, is believed to have an employment multiplier of 1.5 [Ref. 2:p. 117].

When a specific one-shot contract was issued to Boeing for the production of a few Boeing bombers a detailed study was conducted of the Wichita area. The study concluded that the actual local work force increase for a DOD contract was far below the expected civilian industry multiplier of 1.5. The results indicated the multiplier was somewhere between 0.25 and 0.20 and was not considered unusual for a defense

procurement multiplier. The study cited several possible causes for the low multiplier. One hypothesis was that local industry had overexpanded during the preceding boom period and because of excess production capacity could easily handle the Boeing increases. Another was that some of the local businessmen, accustomed to the defense spending ups and downs at the Boeing plant, questioning how long the employment increase would last were reluctant to expand capacity and increase stocks. The same up and down tendency in defense spending also was believed to cause Boeing employees to have a high propensity to save for the slack periods, knowing the high-paying defense work might be temporary [Ref. 2:p. 118].

The end result is that defense spending in a region will have a unique effect on a state economy, often totally different from civilian and other government spending. Many factors shape the effects of defense spending on an individual state. Most important are the direct impact (or size of the defense expenditures) in that state, the composition of the expenditures between payrolls and contract categories, and the location of major defense industries and military installations in the state. Other important factors are the size and degree of diversification of the state's industry, the extent of vertical integration within the defense contractors, and the competitive position of those contractors compared to other states' defense contractors

[Ref. 10:p. 2]. This makes projections of defense expenditure effects within a region or state very difficult.

C. DEFENSE AND NATIONAL GROWTH

Effects of defense spending on the entire United States economy have been studied in depth. Most studies indicate that defense spending has an overall negative impact on the economic growth of the nation. This negative impact results from the real cost of defense, i.e. the cost of human and natural resources and the productive capital being used to provide the national defense. Not only does production of civilian goods and services suffer, but resources that would have potentially been used to increase economic growth, are used instead to maintain military stockpiles. An example of this is the production of a missile.

For example, the same amount of economic activity that went into the production, transportation, and maintenance of a missile could have been used to upgrade the nation's railroads. These railroads would continue to enhance the nation's productive capacity, unlike the missile that is either blown up or dismantled [Ref. 2:p. 29].

If the economy is near full employment then defense spending paid for by taxation and deficit spending will be at the expense of private investment. Taxed income cannot be saved and invested in capital. Deficit spending means the government is bidding resources away from other uses that

could be available to borrow for capital investments. [Ref. 11:p. 106]

The Council on Economic Priorities, an independent nonprofit research organization, conducted two studies on the economic result of defense spending on the United States' economy. One study compared economic growth in several western industrial countries, while the other looked specifically at the U.S. employment impacts of defense spending [Ref. 1:pp. 6-57].

The study on economic growth compared the performance of seventeen western industrial countries over the past twenty years. Several statistical tests were done on a variety of economic indicators to determine the impact of higher real defense expenditures. The results indicate the heavier defense expenditures of the United States contributed to reduced economic and productivity growth compared to other industrial nations. The Council believes this is one of the reasons the economic gap separating America from the rest of the world was closed so fast during the 1960's and 1970's. Several specific examples are cited. Defense spending on high technology military products kept engineers from competing effectively with the Japanese in development of consumer electronic products. While most nations expanded exports during these two decades, the United States became more dependent for defense raw materials, energy and consumer goods. Heavier defense spending in the United States, while

other nations concentrated on increasing industrial strength, is believed to be the cause [Ref. 1:p. 53].

The other study started from the premise that defense spending creates jobs. The study then compared military spending with other types of spending to see if as many jobs were created per dollar spent and how occupational categories with high unemployment were affected. The results indicate that military spending is not an effective jobs program. Fewer jobs are created than most major industries' spending the same dollar amount. Defense typically employs highly skilled people who have little trouble finding work. Military expenditures are highly concentrated in a few regions and do not effectively spread money when trying to reduce unemployment. An important conclusion of the study is that military spending is an ineffective way for the United States to solve national employment and economic problems. [Ref. 1:p. 15] One criticism of this study is that it did not consider military personnel. This type of defense employment via military enlistments is often considered an alternative for poorly skilled, unemployed people. The inclusion of defense spending for military personnel may have found a different result than that reached by the study.

To help evaluate the size and impact of defense spending the Congressional Research Service compiled the following statistics for 1983; national defense outlays were $225.8 billion or approximately seven percent of the Gross National

Product. These expenditures were divided among different categories of defense spending with thirty-nine percent going to weapons procurement, research and development and construction; twenty-seven percent to personnel compensation; twenty-eight percent to operations and maintenance; and five percent to international affairs. [Ref. 12:p. 32]

1983 was a year of economic stagnation, but during that year defense outlays grew 9.6 percent. Leading this growth was a 17.5 percent growth in spending for military hardware and construction. This military spending accounted for roughly twenty percent of the total United States manufacturing and construction industry output of durable goods. Other significant industries were aerospace, shipbuilding and ordinance where defense accounted for forty to sixty percent of the gross output. In the electrical equipment, primary metals, and petroleum industries defense accounted for five to eleven percent of the output. So, for specific industries defense was the major customer during this recessionary period. [Ref. 12:p. 33]

D. DEFENSE AND THE STATES

Significant to this thesis is the highly regional concentration of the defense industries. Heavy concentrations of the aerospace industries occur in California, Washington and Texas. Shipbuilding is concentrated in the coastal states of Virginia, Connecticut, Mississippi, Louisiana, Washington and California. The

ordinance industry is located primarily in New England and the North-Central industrial states.

Two methods of looking at the regional dispersion of defense spending will be shown. These are presented to show how concentrated defense spending is in some states and why defense dollars are expected to be very important to economic growth in those states.

The first method for evaluating defense expenditures uses a total of military and civilian payrolls and defense contracts for goods and services greater than ten thousand dollars for each state. This sum is then divided by the total state private non-farm industry income. This ratio is meant to give a relative picture of the difference in importance of defense expenditures to each state's economy. The results of this comparison for 1981 are presented in Table 2. There is substantial variation in the ratio of defense spending to private income among the states. Virginia ranked first with a ratio of 28.9 percent; over 10 percent above the second ranking state of Connecticut. Adjacent to the highest ranking state of Virginia, West Virginia had the poorest showing with a ratio of only one percent.

The second method of illustrating the relative importance of defense spending across states was developed by the Council on Economic Priorities, and presents the relative state ranking of the net impact of defense spending per worker. This was found by calculating the amount of taxes

TABLE 2

STATE RANKING OF DEFENSE SPENDING AS A PERCENTAGE OF TOTAL CORPORATE INCOME IN 1981 (Billions of Dollars)

	State	Defense Spending	Corporate Income	Defense Percentage
1	Virginia	8.0	27.7	28.9%
2.	Connecticut	4.6	25.2	18.3%
3.	Mississippi	1.7	10.2	16.7%
4.	Missouri	4.9	29.4	16.7%
5.	Maryland	3.3	23.5	14.0%
6.	New Mexico	0.8	6.0	13.3%
7.	Louisiana	3.4	26.3	12.9%
8.	Washington	3.2	26.3	12.2%
9.	California	20.1	168.3	11.9%
10.	South Carolina	1.7	14.9	11.4%
11.	Maine	0.6	5.3	11.3%
12.	New Hampshire	0.6	5.5	10.9%
13.	Arizona	1.6	15.1	10.6%
14.	Kansas	1.5	14.1	10.6%
15.	Utah	0.8	7.6	10.5%
16.	Massachusetts	4.0	39.9	10.0%
17.	Texas	10.3	102.6	10.0%
18.	Alabama	1.7	17.9	9.5%
19.	Delaware	0.4	4.3	9.3%
20.	Georgia	2.8	30.4	9.2%
21.	North Dakota	0.3	3.4	8.8%
22.	Florida	4.5	52.6	8.6%
23.	North Carolina	2.5	31.0	8.1%
24.	Oklahoma	1.5	18.8	8.0%
25.	Vermont	0.2	2.6	7.7%
26.	South Dakota	0.2	2.7	7.4%
27.	Rhode Island	0.4	5.5	7.3%
28.	Colorado	1.4	20.3	6.9%
29.	Kentucky	1.1	17.6	6.3%
30.	Nebraska	0.5	8.3	6.0%
31.	Indiana	2.0	33.9	.9%
32.	New Jersey	2.9	50.9	5.7%
33.	New York	6.7	122.3	5.5%
34.	Nevada	0.3	6.3	4.8%
35.	Idaho	0.2	4.4	4.5%
36.	Ohio	3.2	70.5	4.5%
37.	Pennsylvania	3.2	75.2	4.3%
38.	Minnesota	1.1	26.4	4.2%
39.	Arkansas	0.4	9.9	4.0%
40.	Tennessee	0.8	23.8	3.4%
41.	Michigan	2.0	61.4	3.3%
42.	Illinois	2.2	80.0	2.8%
43.	Montana	0.1	3.7	2.7%
44.	Wyoming	0.1	3.8	2.6%
45.	Wisconsin	0.7	28.6	2.4%
46.	Iowa	0.3	16.2	1.9%
47.	Oregon	0.2	15.2	1.3%
48.	West Virginia	0.1	9.7	1.0%

(Sources: Dept. of Defense and Dept. of Commerce)

each state paid that were used for defense, calculated simply as a ratio of total U.S. defense spending to total U.S. income taxes times the U.S. income tax received from the state. Then a per capita rate was found by dividing the state military tax by the state work force.

Defense spending in each state was divided by the state work force to find the state defense expenditure per worker. The difference between these two ratios (state defense spending per worker and military tax per worker) is the net economic stimulation from defense expenditures each state received per worker. The Council's results for 1981 is presented in Table 3. The greatest economic stimulation per worker was in Virginia with a net defense spending of $2659 per worker, with the least in Oregon with a negative $1036 per worker. [Ref. 1:p. 161]

E. DEFENSE IMPACT PROJECTIONS

Despite the difficulties in predicting the impact of changes in defense expenditure on a state or region some research has been done. In 1975 Roger Bezdek used a policy simulation model to project the results of two possible compensated shifts in defense expenditures on regional manpower. He looked at a possible thirty percent increase or decrease in defense expenditures and then forecast the 1980 percentage change in regional employment. [Ref. 13]

The results for the nation were similar to those on the previously illustrated distribution of defense spending. A

TABLE 3

STATE RANKING OF NET DEFENSE SPENDING PER WORKER IN 1981
($ per worker)

State	Defense Spending	Defense Tax Burden	Net Impact
1. Virginia	3970	1311	2659
2. Connecticut	3108	1625	1483
3. Utah	2327	1096	1231
4. Mississippi	2178	968	1210
5. Missouri	2440	1312	1128
6. New Mexico	2155	1129	1026
7. California	2376	1454	922
8. Louisiana	2132	1224	908
9. Washington	2347	1448	899
10. Maryland	2195	1452	743
11. Arizona	1832	1155	677
12. Massachusetts	1981	1306	675
13. Texas	1910	1277	633
14. Oklahoma	1820	1197	623
15. Georgia	1608	1074	534
16. South Carolina	1526	1041	485
17. New Hampshire	1676	1199	477
18. Colorado	1672	1226	446
19. Alabama	1595	1152	443
20. Maine	1493	1073	420
21. Florida	1510	1252	258
22. Kansas	1476	1329	147
23. North Dakota	1324	1242	82
24. North Carolina	1030	1017	13
25. Delaware	1547	1537	10
26. Rhode Island	1143	1235	-92
27. Vermont	845	965	-120
28. Nevada	1100	1243	-143
29. Kentucky	931	1136	-205
30. South Dakota	745	1064	-319
31. Arkansas	651	990	-339
32. Indiana	897	1382	-485
33. Wyoming	832	1358	-526
34. New York	1011	1546	-535
35. Tennessee	596	1133	-538
36. Nebraska	758	1298	-540
37. New Jersey	1069	1625	-556
38. Ohio	901	1463	-562
39. Idaho	570	1140	-570
40. Minnesota	694	1281	-587
41. Pennsylvania	826	1420	-594
42. Montana	596	1236	-640
43. Wisconsin	351	1239	-888
44. Iowa	403	1374	-971
45. Michigan	603	1602	-999
46. West Virginia	280	1295	-1015
47. Illinois	599	1630	-1031
48. Oregon	285	1320	-1035

(Source: Council on Economic Priorities [Ref. 1])

thirty percent decrease in defense spending would likely increase employment two percent nationally while a thirty percent increase in defense spending would cause employment to decrease about 1.3 percent. The impact on regions and individual states varied considerably. Some states benefited greatly by the decrease in defense spending while others suffered severe adverse effects. Middle Atlantic states such as Pennsylvania and New Jersey, Midwestern states like Illinois and Indiana, and New York state all saw employment increases in the five percent range given a thirty percent reduction in defense spending. The Mountain states and California were projected to have about a one percent loss in employment. An increase in expenditures caused the reverse to happen with California and the Mountain states gaining about one percent in employment while the Middle Atlantic and Midwestern states lost about three percent. States of three regions of the country--New England, Lower South Atlantic, and East South Central--were projected to be almost unaffected given either a rise or decrease in defense spending. [Ref. 13:p. 193]

Moving from the national level, the Congressional Research Service (CRS) in 1985 examined the effects of defense spending on the state of Mississippi. In fiscal year 1984 Mississippi received defense dollars totalling a little over three million. That was about 1.6 percent of the national total with eighteen states receiving more. The

emphasis in the CRS study was on the contribution of defense to the total output and employment in Mississippi. [Ref. 10]

Mississippi's economy was not dominated by manufacturing in 1984, with manufacturing only accounting for twenty-five percent of nonagricultural employment. Among non-manufacturing industries the public sector was by far the largest employer. State, Federal and local government agencies accounted for a total of twenty-three percent of the nonagricultural employment in the state. Defense spending in the state followed the economy's structure. Two industries received over fifty percent of defense dollars spent in the state; shipbuilding received $1,016 million and DOD military and civilian payrolls accounted for $840 million in 1984. [Ref. 10:p. 7]

The study used two related measures to analyze defense spending's impact on economic activity in Mississippi. One was the share of total state output accounted for by military demand and the other was the contribution of defense spending to total employment.

Defense spending in 1984 accounted for 7.6 percent of total state output. In projecting defense expenditures to 1990 defense spending is expected to rise to 8.4 percent of the total output. This projection of a ten percent increase in the defense share of total output means that defense is expected to be a stable source of economic growth for Mississippi for the rest of this decade. In fact, annual

projections for total state growth in output is at a rate of 3.1 percent, while defense related output is projected to grow at an annual rate of 4.7 percent. [Ref. 10:p. 9]

In 1984, defense was estimated to account for 5.7 percent of the total employment in Mississippi. CRS projections show an increase of 20 percent by 1990 or a defense share of 6.9 percent of total state employment. Again, defense is expected to be a major source of employment growth for the rest of the eighties. Annual employment growth for Mississippi is projected at an average annual rate of 1.4 percent compared to defense related employment growth at an annual rate of 4.7 percent. [Ref. 10:p. 11] All this points out how significant defense spending can be to a state's economic growth. In Mississippi defense is a prime contributor to total output and employment growth.

Defense spending can have an even more significant impact on a state subsystem such as a county or city. In an econometric analysis of Philadelphia in 1977, Norman Glickman studied the impact of a defense spending reduction. This reduction was actually occurring due to decreases in activity at the Defense Industrial Supply Center and the Philadelphia Naval Base. The total direct impact of this reduction was $95 million in 1975. Projecting the total result of this decrease resulted in total direct and indirect impacts of $161 million over an eight year period. The total impact on manufacturing was almost immediate with nearly 80 percent

recorded in the first year. Nonmanufacturing activity started with feeling almost no impact due to the decrease and built to a total of $100 million after eight years. This translates to a total $290 million loss in personal income. [Ref. 14:p. 180]

The political nature of such cuts can be readily seen. Any region facing such a cut in defense spending will bring whatever pressure possible to avoid taking that cut. Additional defense spending is expected to have the opposite growth effect on a region and causes these dollars to be actively pursued.

The next chapter looks at how a state or region grows. Several econometric models are reviewed to provide a basis for the growth model presented in Chapter IV.

III. REGIONAL GROWTH

A. INTRODUCTION

During the last decade states have grown at different rates. In the long-run, differences in real wages and other factor prices should disappear through trade and migration across states. This should equalize per capita income. In fact, as previously mentioned, this was the trend in per capita income until 1979. But this trend has reversed and differences in state growth are becoming more pronounced. This apparent contradiction to economic theory has generated interest in determining why states grow and why differences in economic growth rates exist. This chapter will present some of the facets of state economic growth with a major portion devoted to a review of empirical models of regional and state growth.

B. FACTORS OF GROWTH

The multiplier effects of a change in economic activity were discussed in the previous chapter. In that context the expected impact of changes in defense spending on state economic growth was discussed. But the multiplier effect on state growth goes beyond just defense spending. Any change in state economic activity will set into motion a set of associated actions that will impact on economic growth and decline.

This is illustrated in an example of how a state might react to the development of a new resource in a relatively unpopulated part of the state. This new resource could come from any source: technology, discovery, or a change that allows the production of a good to be profitable.

First, an investment would be made in resource facilities. This investment would cause an immigration of workers and their families. Community development of facilities and services such as housing, roads, and public utilities would take place. Transportation links between the developing area and the rest of the state would be improved.

This population growth would be expected to attract businesses such as grocery and department stores and restaurants. Along with the initial resource development these would bring in materials suppliers and business services.

All of this new construction and market growth would continue to attract more workers, and further expansion of the population would attract more business ventures. As the initial mix of people and businesses becomes more complex more specialty industries would be attracted. Additionally, industries that require larger market areas would begin to be drawn into the area. Transportation links to the area would continue to improve. The growth of the area would also begin to attract specialized services and financial sources. These, in turn, would pull in businesses that look for these

services when making a location decision. Growth would continue as the region became more populated and exterior demand stimulated even more production. [Ref. 15:p. 95]

This is only an example of economic growth. Not all growth will follow a similar chain of events. If the area was already densely populated the impact of new development would not be as marked. Also, a shortage of labor could drastically change the above sequence. The loss of an industry would be expected to have the reverse effect on an area. The impact on a state of economic change will in part be determined by the multiplier effect and the growth or decline sequence the change initiates. Also, there may be an offset elsewhere in the state if new firms compete with existing ones within the state. Most state growth models attempt to explain differences in growth by studying factors that might cause a resource to be developed. This is supplemented by state characteristics such as fiscal policy, business climate, and climatic conditions that would cause the rate of growth (or decline) in one state to be different from another.

Typically, in discussing state growth the differences between a declining state and a growing state are relative. During the last decade the United States experienced a period of economic growth and in absolute terms most states also grew. But in comparing states and regions to the national growth averages, some states can be classified as declining.

Another distinct difference between state economic growth rates is the difference between relative and absolute growth. While per capita income in the South shows the greatest gain relative to the rest of the nation, in absolute terms Southern per capita income is still below that of the Northern states.

There are two basic measures of economic growth. One is the change in the economic welfare of the individual. The other is a change in a volume measure of economic activity. [Ref. 16:p. 12]

State economic growth in volume can be measured several ways. Two typical measurement methods are employment growth and total income growth. Growth occurring from expansion in available labor force and consumer numbers cause both of these indicators to hinge on population growth. Population growth has not been equal throughout the United States. Some areas of the Northeast have actually had declines in population since 1976 [Ref. 17:p. 3]. Since birth rates in the United States have, as a whole, been declining over the last decade, most of the differences in population growth between states are attributed to interstate migration. For instance, between 1975 and 1980 seventeen percent of the population growth in Western states was attributable to a net in-migration. In contrast, states in the North and East Central regions had net out-migration rates that resulted in a loss of 3.3 percent and 5.2 percent of their 1970

population by 1980 [Ref. 17:p. 10]. These population changes reflect back on the differences in employment and income growth between states. As might be expected the relative gains in employment growth and total income growth as indicators of economic growth have mirrored regionally the population results. There has been a decline in the North and substantial gains in the South.

This exemplifies the difference between the welfare aspects of economic growth and those of volume. States that experience declining population and relative declines in total income could still have an overall increase in the welfare of the state's population as measured by per capita income.

The most commonly used measure of individual welfare is the level of per capita income and changes in that level. This is a crude indicator of economic welfare, showing an individual's relative economic standing, as well as providing a measure of improvement or decline in that standing. Per capita income growth is determined by total income growth and changes in population. Typically, per capita income growth is used as the measure of economic growth when comparing nations. Usually continual increases in population of a country can be taken for granted. Due to restrictions in migration between countries, population can provide a good way to attach a numeric floor to economic growth. Even though income or volume growth takes place in a country, if

it does not keep ahead of population growth the country is not considered to be growing economically. [Ref. 15:p. 97]

When per capita income is used to compare states the migration restrictions are removed. Individuals can freely move from one location to another making population growth no longer a given fact. As mentioned, over the last decades population declines have occured in some states. In those states, if total income remains the same, or even declines, per capita income can still increase, creating a divergence between volume growth and welfare growth. [Ref. 15:p. 98].

The next section is a literature review of several state economic growth models. They studied some measure of volume or welfare growth or both. The models and the variables they found to be significant in explaining state growth provided a basis for the model of state growth used in this thesis.

C. MODELS OF STATE GROWTH

Most of the econometric models of state economic growth are based on cross-sectional analysis. In this literature differences between state economic volume and welfare measures are related to across state variations in market and cost variables hypothesized to affect the chosen economic measure. A summary of the following growth models is presented in Table 4. By far the most common theme is to analyze state employment and manufacturing growth.

Plaut and Pluta (1983) examined manufacturing growth for the 48 contiguous states for two separate periods: 1967-72

TABLE 4
SUMMARY OF GROWTH MODELS

CROSS-SECTIONAL MODELS

STUDY	YEAR	DEPENDENT VARIABLE	SIGNIFICANT EXPLANATORY VARIABLES	IMPACT
PLAUT, PLUTA	1983	1) MANUFACTURING EMPLOYMENT	BUSINESS CLIMATE	(+)
			STATE TAXES	(-)
			CLIMATE (Arid)	(+)
			EDUCATION EXPEND.	(+)
			WAGE RATE	(+)
			UNEMPLOYMENT RATE	(+)
			UNION ACTIVITY	(-)
		2) MANUFACTURING CAPITAL STOCK	ENERGY COSTS	(-)
			LAND COSTS	(-)
WHEAT	1973	MANUFACTURING EMPLOYMENT	MARKETS	(+)
			CLIMATE (Hot)	(+)
			WAGE RATE	(-)
			UNION ACTIVITY	(-)
	1986	MANUFACTURING EMPLOYMENT	SAME RESULTS AS 1973 STUDY (Despite new explanatory variables being included)	
NEWMAN	1983	EMPLOYMENT	CORPORATE TAXES	(-)
			UNION ACTIVITY	(-)
			RIGHT-TO-WORK LAWS	(+)
WASYLENKO, MCGUIRE	1985	EMPLOYMENT	WAGE RATE	(-)
			ELECTRICITY COSTS	(-)
			STATE TAXES	(-)
			EDUCATION EXPEND.	(+)
CARLTON	1979	FIRM LOCATION CHOICES	WAGE RATE	(-)
			ELECTRICITY COSTS	(-)
			INDUSTRIAL ACTIVITY	(+)
	1983	EMPLOYMENT CHOICES OF FIRMS	ENERGY COSTS	(-)
			EMPLOYEE DENSITY	(+)

TABLE 4 (CONTINUED)
SUMMARY OF GROWTH MODELS

STUDY	YEAR	DEPENDENT VARIABLE	SIGNIFICANT EXPLANATORY VARIABLES	IMPACT
BARTIK	1985	FIRM LOCATION CHOICES	CORPORATE TAXES	(-)
			UNION ACTIVITY	(-)
			EMPLOYEE DENSITY	(+)
SCHMENNER, HUBER, COOK	1987	FIRM LOCATION CHOICES	UNION ACTIVITY	(-)
			WAGE RATE	(-)
			STATE EXPEND.	(-)
			CLIMATE (Hot)	(+)
			POPULATION DENSITY	(-)
ROMANS, SUBRAHMAYAM	1979	1) PER CAPITA INCOME	TRANSFER PAYMENTS	(-)
			BUSINESS TAXES	(+)
			REGIONAL INCOME	(+)
		2) PERSONAL INCOME	SAME AS PER CAPITA INCOME RESULTS AND INCOME TAXES	(-)
CANTO, WEBB	1987	PER CAPITA INCOME	STATE TAXES	(-)
			NATIONAL INCOME	(+)
POOLED CROSS-SECTIONAL TIME SERIES MODELS				
HELM	1985	PERSONAL INCOME	FEDERAL TRANSFERS	(-)
			STATE EXPEND.	(+)
			STATE TAXES	(-)
			POPULATION DENSITY	(-)
FINCH	1987	PERSONAL INCOME	FEDERAL EXPEND.	(-)
			STATE EXPEND.	(+)
			POPULATION DENSITY	(+)
			DEFENSE EXPEND.	(+)

and 1972-77. They used three dependent variables as measures of growth: percentage changes in manufacturing value added, in manufacturing employment, and in manufacturing capital stocks. The explanatory variables include several measures of accessibility to markets, cost and availability of factors of production, climate and other environmental factors, and state business climate, which includes measures of state taxes and expenditures.

Their analysis concluded that growth in manufacturing employment is strongly related to climate and labor factors such as wages, unemployment and union activity. For growth in capital stock, energy and land costs were found to be the most significant factors. Perhaps most unusual is the study's conclusion that accessibility to markets is relatively unimportant to state growth.

Among the explanatory variables, a poor business climate with a high overall tax effort by the state was found to have a significant negative impact on employment growth. Education expenditures had a positive effect on employment growth, while state welfare expenditures were found to be insignificant. [Ref. 18]

The Plaut and Pluta study received a lot of criticism due to the conclusion that markets were relatively unimportant in explaining state growth. One article by Leonard Wheat stated that the reason for this result was that several other variables in the study were serving as proxy variables for

markets. These included the population density variable, used as a land availability indicator, and an aridness measure used as a climate indicator. Wheat felt the aridness measure identified the fast growing Southern and Western markets from the rest of the nation, and that this market proxy effect caused the variable to be significant. Also, Wheat felt unemployment is a proxy for slow growth and should not have been included as an explanatory variable. He felt this variable alone caused a significant distortion in Plaut and Pluta's overall results. [Ref. 19]

Wheat (1973) had developed his own model of state economic growth prior to Plaut and Pluta's article. His study used absolute manufacturing growth, per capita growth and percentage growth as the dependent variables. His explanatory variables included measures of markets, agglomeration, thresholds, urbanization, labor factors, resources and climate. Wheat concluded markets were the most significant determinant in state growth. Climate and labor factors were also found to play an important part in manufacturing gains. [Ref. 20]

In a subsequent study Wheat (1986) again analyzed the percentage change in manufacturing employment. He included the same explanatory variables as before plus variables for state taxes, business climate, and retiree in-migration. His results were almost unchanged. Markets were the most significant factor in explaining employment growth. In

particular, total state income divided by manufacturing employment was the most significant explanatory variable. Wheat argued that this is a measure of the ratio of market demand to market supply. Climate, as measured by maximum July temperature, was the next most significant variable. Percentage unionization and manufacturing wages were found to have significant negative effects on employment growth.

Some of the variables that Wheat found to be insignificant in his studies are surprising. Both state taxes and business climate were found to be relatively unimportant. Resource costs were also found to have a negligible impact on employment growth. [Ref. 21]

Another study looking at growth in several manufacturing industries was done by Newman (1983). As his dependent variable he used the difference between state employment growth and the national average of growth for thirteen industry groups as well as pooling the industry results. His independent variables were corporate taxes, change in unionization, and a dummy variable representing states with right-to-work laws. The study found evidence that higher corporate taxes negatively affected employment growth rates and was especially important in explaining slow growth in capital intensive industries. [Ref. 22]

Wasylenko and Mcguire (1985), in their article on state employment growth, criticized other recent studies for concentrating on manufacturing. They felt that, since the

manufacturing sector has been shrinking in terms of employment over the past decade it was a poor proxy to measure state economic growth. They analyzed employment growth across several industries using the percentage change in manufacturing, transportation, communication and public utilities, wholesale and retail trade, finance, insurance, and real estate services, and then the total change in all these industries combined as the dependent variable. Their explanatory variables were measures of market access, labor force characteristics, energy prices, climate, business climate, and agglomeration economies.

From the prospective of total employment growth they found average industry wage rates to have a significant negative impact on growth. Electricity costs and overall tax efforts by the state also had important adverse effects. But as a caveat to the negative tax effects if the state spends the taxes on education the result is a positive impact on employment growth. They point out that wages and energy prices are beyond the control of state policy makers and are the largest contributors to low employment growth rates. Increased state spending will not produce significant growth in most states fighting slow growth because of the effect of these variables. [Ref. 23]

Another common theme in explaining state growth is examining reasons new firms choose to locate in a particular state. Carlton (1979), in examining firm location choices,

looked at the importance of taxes and fiscal incentives. He analyzed births of firms in Standard Metropolitan Statistical Areas (SMSA) from 1967 to 1975. His variables included wages, labor supply, proximity to markets, unemployment rates, a business climate index, and corporate, personal income and property taxes.

Wages and electricity prices were found to have a significant negative impact in firm location choices. Carlton's results also indicated that taxes and business climate played little or no role in state selection. The existing amount of industrial activity, measured by the agglomeration variable, had a large influence in the number of new starts. [Ref. 24]

In a subsequent article, Carlton (1983) developed a model linking SMSA location decisions and employment choices of new branch plants. The employment choice represents the number of new hires the plant would make. He again found energy costs had a significant impact. Existing concentrations of employment are very important especially to a firm locating a relatively small plant. Taxes and state incentives again played little role in firms' decisions. [Ref. 25]

Bartik (1985) also examined new plant location decisions of firms. His decision variables represented energy prices, taxes, labor costs, and agglomeration economies. His results tend to contradict Carlton's. Bartik's study found that corporate income taxes and unionization had a significant

negative impact on firm location choices. Wage rates and electricity cost were insignificant to the firms' decisions in this study. He concurred with Carlton that agglomeration economies were important. In particular employees per acre and highway miles were found to be significant positive factors in the state chosen. [Ref. 26]

The differences in these two studies should be emphasized. Carlton was looking at firms' decisions to locate in a particular SMSA, while Bartik was examining firms' decisions to locate in a particular state. Schmenner, Huber, and Cook (1987) explain that a firm's decision on where to locate a new plant is really a two-stage process. In the first stage the firm decides to locate in one of a few particular states. After the location choice has been narrowed the second stage in the selection process is to choose the actual location of the plant. Different variables are important in each stage of the selection process.

Their study found that firms in the first stage of the process place the most emphasis on avoiding unionism and higher wages as well as higher spending states. Warmer climates were preferred and in general firms favor location in low population density areas. After the choice is narrowed to a few states, unionism and labor wage rates were found to be insignificant. At that point climate also becomes unimportant. Now firms seem to seek states that have low taxes and high expenditure rates. The researchers feel

this is a kind of bargain hunting effort by the firms. [Ref. 27]

Welfare economic growth in states was examined in a study by Romans and Subrahmanyam (1979). Their dependent variables included per capita income growth as well as total income and employment growth. They were particularly interested in the impact of state taxes on economic growth. Their independent variables included a marginal tax rate, state personal income tax revenues versus a national average, state business tax revenues versus a national average, adjusted transfer payments, regional income change exclusive of the state, and non-agriculture versus agriculture income. In the analysis of per capita income growth transfer payments were found to have a significant negative impact. Business taxes and the regional income variable had positive significant impacts. The researchers argued that the unexpected result for business taxes was due to businesses getting something in return for the taxes they paid. The total income growth model results were similar, showing a significant negative impact for state transfer expenditures. Business taxes and regional income again had positive significant impacts. The volume growth version did find a significant negative effect for personal income taxes. [Ref. 28]

Canto and Webb (1987) also examined per capita income growth. They used three categories of explanatory variables; state expenditures, state taxes, and per capita income of the

United States. The relative tax burden was found to have a significant negative impact on growth. However, how those taxes were used (either for government purchases or transfer payments) had an insignificant impact on state growth. They also found a significant positive impact of national growth on the state. [Ref. 29]

Business climate is a common explanatory category. Almost all of the models reviewed tested some version of business climate in their analysis. Two studies were frequently cited as sources for measures of state business climate and were either used as measures of the climate or as a basis for choosing business climate variables.

One of those studies was prepared by Alexander Grant and Company for the Conference of State Manufacturers Association (COSMA). This study weighted eighteen criteria to provide a relative ranking of the states business climate. The criteria used were:

1. Labor union percentage
2. Energy cost per million BTU's
3. Average manufacturing wage
4. Days lost due to work stoppages
5. State taxes per capita
6. Net worth of state unemployment
7. Percentage change in energy cost
8. Vocational education spending per capita
9. Percentage change in state taxes per capita
10. Private pollution abatement expenditures compared to value of shipments
11. Unemployment compensation benefits per worker
12. Manufacturer's pollution abatement expenditures per capita
13. Percentage change in per capita state debt
14. Workers compensation insurance rate per $100
15. State spending versus state income growth
16. Maximum benefit paid workers disability

17. Amount of state debt per capita
18. State spending per capita

Examined for the 10 year period from 1969 to 1978, percentage changes in these criteria were used to provide a state ranking. The study noted a general correlation between manufacturing employment growth and the relative business climate ranking. [Ref. 30]

Another study commonly referred to was conducted by the Fantus Company for the Illinois Manufacturers Association. This study used very similar variables as the COSMA study but looked at absolute levels rather than percentage changes. [Ref. 17:p. 114] There is a fairly good correlation between the results of these two studies.

D. POOLED TIME SERIES AND CROSS-SECTIONAL RESULTS

Two studies are separated from the rest because the regression method used to examine state growth was the same as the one used in this thesis. Most of the other models discussed in this chapter used a cross-sectional regression model to determine which explanatory variables had the most influence on state growth. The dependent variables serving as a proxy for growth were usually a measure of change in some welfare or volume statistic for each of the states over a period of time. In the pooled time series and cross-sectional models of state growth used by Helms and Finch there is a dependent variable equation for all years and for all states in the study.

Helms (1985) used data from the period 1965 to 1979 for the 48 contiguous states. His proxy for state growth was state personal income. His explanatory variables were measures of taxes and other state revenue, public expenditures, and demographic and labor force characteristics.

Helms used a budget constraint equation to force his regression coefficients to be directly related to the dependent variable. This budget constraint equation uses federal transfer payments to equate state spending with state taxes. The total of state expenditures are set equal to total tax collection plus deficit spending plus federal transfers. The federal transfer amount is a plug to force equality of state expenditures versus state revenues. Additionally, Helms uses the lagged value of the dependent variable as an explanatory variable. This accounts for the short run contribution of immobile factors of production. The model also included state and year dummy variables.

The state (or case) dummy variables in Helms' model represent state specific characteristics that do not change over time, such as region, climate, location, and quantity and quality of land. Note that in previous cross-sectional models specific explanatory variables were used to take into account these characteristics. The time dummy variables account for nation-wide economic factors affecting all states in a given year.

Helms' found significant impacts for all variables in his budget constraint equations. State taxation and deficit spending had a negative impact on growth. The state expenditure variables all had positive impacts. Federal transfers, however, had a negative influence. Helms feels this is due to the requirements attached to transfer funds by the federal government, such as matching funds or required earmarked spending. The only other significant explanatory variable was population density, which had with a negative influence on state growth. [Ref 31]

A master's thesis completed by Finch (1987) contained a model of state growth that included defense expenditures as an explanatory variable. Specifically, defense procurement contracts were used as a measure of defense spending in a state. The model was a pooled cross-sectional time series using data from 1976 to 1981. The proxy for state growth was state personal income. Besides defense spending, explanatory variables included other Federal expenditures, state expenditures and taxes, measures of the state business climate, and state and time dummy variables.

The results of this study were similar to those of Helms. Federal expenditures for education and highways were significant and had a negative impact on state growth. State expenditures were significant with a positive impact on growth. State taxes and other measures of state business climate were found to be insignificant. However, contrary to

Helms' results, population density had a highly significant positive impact on state growth. Perhaps most important, defense expenditures were found to have a significant positive impact on state economic growth as measured by personal income. This was in contrast to the negative impact of federal spending for education and highways. [Ref. 4]

E. OTHER DEFENSE STUDIES

There have been other studies attempting to determine the impact of defense expenditures on state growth. In one such study Menegakis (1970) used discriminate analysis to see if states that had high levels of defense spending could be singled out, using different economic and demographic variables, from states that did not have high levels of expenditures. The study analyzed economic and demographic data from 1950 to 1960. At the state level this study found no significant differences between states with high defense spending and those with low defense spending. On the county level the study found the level of military activity had a direct affect on the economies of counties. [Ref. 32]

Bolton (1966) conducted an in-depth study of defense spending and regional economic growth using an input-output model. The study used defense spending as a percentage of state exogenous income and analyzed the period of 1947 to 1962 to determine the impact this spending had on state growth. Bolton concluded the impact of defense spending depended on two factors. The first was the weight of defense

income relative to all income received from outside the state. The second was the rate of defense spending growth. Specifically, Bolton felt that the Middle Atlantic and East North Central states would have had higher growth with higher defense spending because excess production capacity existed during the period studied. Both the Mountain and Pacific states showed higher levels of growth relative to the rest of the Nation due to heavy increases in defense spending as measured by total economic activity and population growth. [Ref. 33]

In another study of defense spending impact on states Weinstein (1985) concentrated on migration patterns of military members. From 1965 to 1970 military personnel accounted for 14.2 percent of all interregional migration. These relocation decisions by the Department of Defense resulted in a loss of over 200,000 people from the Northeast and North Central states with a corresponding increase in Southern and Western states. Weinstein's studies indicated the impact of these moves was compounded by decisions of military members to stay in the region where they are stationed when leaving the armed forces. Also, military retirees tended to locate close to military bases. Presumably this is done to take advantage of exchange and medical privileges. California, Texas, Virginia and Florida (the states with the largest number of military installations) have all shown large growth in the number of

military retirees migrating into the state. [Ref. 17:pp. 19-27]

Based on the above literature on state growth and defense impacts the next chapter develops the model and identifies the variables used in this thesis. In addition the statistical techniques used to analyze the data are discussed.

IV. THESIS MODEL

A. INTRODUCTION

Multiple regression analysis can be used to explore the relationship between a set of independent variables and a dependent variable. By estimating the independent variable coefficients an explanatory model can be used to show how changes in the dependent variable can be explained by changes in the independent variables. This relationship can then be used to estimate the effect changing an independent variable has on the dependent variable. In this thesis a statistical model was developed using a proxy for state economic growth as the dependent variable and including defense expenditures among the independent variables. This chapter develops that statistical model.

Typically, econometric models using multiple regression techniques base the model on a sample of cross-sectional data. As mentioned in the previous chapter all of the growth models discussed, except the models by Helms and Finch, used cross-sectional data. This means a model using cross-sectional data from the forty-eight contiguous states uses forty-eight observations to estimate the coefficients. However, this thesis pools cross-sectional and time series data covering a ten year period, and thus has 480 observations. This much larger sample size allows a more

accurate assessment of the relationships between the independent and dependent variables.

B. VARIABLES AND DATA SOURCES

This section discusses the dependent and independent variables used in the model. As discussed previously, personal income was used as the dependent variable in the regression equation. The other variables are included in the equation in an attempt to explain the variation in personal income. Defense spending will be among the explanatory variables. It is the impact of this spending that constitutes the focal point of this thesis. By estimating the regression coefficients for components of defense spending their impact on state growth can be inferred.

But the model must reflect other explanatory variables as well. State spending and taxation are expected to play a role in differences in state growth rates. These are often considered part of the states' business climate--its ability to attract and hold firms. Other business climate variables are also reflected in the model.

Additionally, a pooled cross-sectional and time series model should include dummy variables. One set of dummy variables will reflect state specific characteristics. These will include such things as climate, location, and state laws. The other set of dummy variables will reflect time dependent characteristics. Perhaps the most important of these to this model is national economic growth. The use of

these dummy variables is to adjust for important information omitted from the model.

The following sub-sections list the variables used in the model. The data sources from which the variables were obtained are included.

1. Personal Income

This variable served as a proxy for economic growth. In the "volume growth" model total personal income is the dependent variable. In the "welfare model" per capita income is used. The basic income data is composed of wages plus other labor and proprietors' income. Personal contributions for social insurance are deducted from that total. Dividends, interest, rent and transfer payments are then added to give total personal income for a state in a given year. The source of these data was the U.S. Department of Commerce, Bureau of Economic Analysis, "State Personal Income," Survey of Current Business, table 3, various volumes.

2. Defense Expenditures

Defense outlays are divided into six independent variables. The first two are military and civilian payrolls. These are gross earnings by military and civilian employees of the Department of Defense. The spending was reported by disbursement location and includes allowances such as basic allowance for subsistence for military employees. As discussed in Chapter II, the impacts of these two types of payrolls are expected to be different from each other, and

from other types of military outlays,and for that reason they are separated.

The other four components of defense spending are Department of Defense contracts for procurement, research and development, services, and construction. Procurement contracts are for the purchase of all goods ranging from weapons systems to office supplies. Research and Development funds include payments to contractors for specific weapons systems, and general scientific research grants to colleges and universities. Service contracts are for various contracted labor activities, such as running of a defense facility, building repair contracts, janitorial work, and equipment maintenance. Construction contracts are for new facilities built for the Department of Defense.

Due to the different nature of each type of contract the impacts on the state are expected to be very diverse. For instance, procurement contracts are highly capital-intensive while service contracts are mostly labor-intensive. Construction contracts, unlike the others, will impact a very specific sector of the economy in each state. Because of these differing effects the contracts are separated to provide a more in depth view of how defense spending impacts state growth. The data used is for contracts greater than $10,000 up until 1983, after which the Department of Defense changed to keeping totals only on contracts exceeding $25,000. Construction and service contracts are for work

performed in a given state. Procurement and research and development contracts are by factory location that performed the largest dollar amount on a contract or by contractor home office. All dollars spent on contracts are treated as occurring in the state assigned in the year awarded, and sub-contract effects are ignored.

There was a problem in compiling the data for defense expenditures. During 1976 to 1980 the Community Services Administration, Geographical Distribution of Federal Funds in Summary, compiled these data for the Executive Office of the President. However this publication was discontinued in 1980. The Directorate for Information Operations and Reports (DIOR), Department of Defense Atlas/State Data Abstract for the United States started publishing the same statistics for defense spending in 1982. These two sources were used, but, unfortunately, this left data unavailable for 1981.

For 1981 payroll data were taken from the U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States. Research and Development contract data were available from DIOR, DOD Prime Contract Awards by Region and State. This same publication did provide a total figure for procurement, services and construction contracts for each state in 1981, but no breakdown by type was provided. In conversations with DIOR it was discovered that the data are available on an unloaded computer tape, but they do not run custom reports. As far as

DIOR is concerned, since a data sort by the three type of contracts has never been done for 1981, the data is unavailable [Ref. 34].

The missing 1981 data necessitated applying a weighted average proxy for the 1981 defense expenditures. Based on the 1980 and 1982 expenditures, a percentage was applied for each of the three contract categories to the total expenditure for 1981. When the regression was actually done both the model with the calculated separate contract values and a model with a combined contracts variable were run. The results indicated that using separate contracts with proxy values for 1981 data was acceptable.

3. State Expenditures and Taxation

The differences in state fiscal policies should also have an impact on the relative rate of state growth. Normally, state expenditures and taxation policies are considered part of a state's business climate. This is expected to play an important role in growth due to firms considering state business climate in locating or expanding plants or services. Four variables are used in the model to reflect state fiscal policy.

The first two variables are measures of state expenditures. One consists of the sum of state spending for health, hospitals, education, and highways. These are considered outlays on "infrastructure" and might be thought of by firms or employees as desirable expenditures. These

expenditures are expected to make the state a more attractive place to live, or reduce the cost of producing in the state. The other variable is state welfare spending, generally viewed as an undesirable expenditures by firms. Welfare payments are often considered as a detriment or burden on a state. High welfare payments might be expected to adversely affect firm location decisions. Both of these expenditure variables include federal transfers for these purposes within a given state.

The other two fiscal variables represent state taxation for individuals and corporations. Due to the forty-eight different tax structures, direct comparison of tax variables is practically impossible. Instead, the variables used are proxies for taxation; a nominal tax rate is calculated for each state. The proxy variable for personal income taxes is total state revenue from personal income taxes divided by state personal income. The corporate tax rate proxy equals total state revenue from corporate income taxes divided by private, non-agricultural business income.

The data for state spending and revenues came from the U.S. Department of Commerce, Bureau of Census, State Government Finances, various volumes. The personal income and corporate income statistics were taken from the previously cited Survey of Current Business.

4. Other Business Climate Measures

To gain a more complete picture of the business climate of the state three other variables are included in the growth model. The first of these is population density. This is the total state population divided by land area. This variable serves as a measure of the market potential in a state for goods and services.

The cost of labor in a state is expected to play a part in state growth. To account for this, the average manufacturing wage rate is included as an explanatory variable. This is expected to be indicative of the prevailing overall wage rates in a state in a given year.

Finally, a lot of attention has been focused on the decline of the manufacturing belt. The dependency of a state on manufacturing is expected to have both a positive and negative effect. On the one hand, agglomeration effects would be expected to help state growth, the idea that industry attracts industry. On the other, manufacturing in the United States has been declining during the last decade, and those states that are heavily dependent on manufacturing have not grown as rapidly as the rest of the nation. To capture the effect of manufacturing agglomeration, a proxy variable was used that equalled manufacturing employment divided by population.

Data for population, land area, and average manufacturing wage were taken from the U.S. Department of

Commerce, Bureau of the Census, Statistical Abstract of the United States, various years. Data for manufacturing employment was from U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics.

5. Omitted Variables

Two specific variables felt to be important in modeling state growth were omitted from the model. One is a measure of energy costs and the other is a measure of state unionization. Both are believed to be important to a state's growth in a way not reflected by other explanatory variables. However, consistently collected data for every state and each year of the ten year period could not be found. This omission is expected to increase the significance of the state dummy variables in the regression equation. The state dummies may in part reflect regional differences in electricity costs and unionization, while the time dummy will reflect overall national trends.

6. Model Variations

In the volume growth model total dollars are used for both the dependent variable and defense and state expenditure variables. The welfare growth model uses per capita data for the above variables. The rest of the variables are the same in both models.

All data that are in dollars are deflated. Department of Defense deflators were used for all defense expenditure variables. Personal and corporate income, as well as

manufacturing wage variables, used GNP deflators. State government deflators were used for state revenue and expenditure variables. The deflators were taken from t previously cited Survey of Current Business.

Table 5 presents descriptive statistics for the fourteen variables used in the volume growth model. Note that all dollar figures in this model are in billions of dollars, except average manufacturing wage. Table 6 presents descriptive statistics for the variables in the welfare growth model.

C. CORRELATION ANALYSIS

Correlation is used to measure the strength of association between variables. The strength of a relationship between two variables is represented by r, the coefficient of correlation. The coefficient of correlation can range between -1 and +1. If there is a perfect one for one relationship between variables, r will equal (+1). When the variables are not related r will equal zero. A perfect negative correlation will result in an r of (-1).

The correlation matrix for the volume growth model is shown in Table 7. The high values of the coefficients of correlation between independent variables indicate multicollinearity may occur in the regression model. Multicollinearity means there is a linear relationship between two or more of the independent variables and that changes in one variable are associated with changes in other

TABLE 5

DESCRIPTION OF VARIABLES: VOLUME GROWTH MODEL

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM
PERSONAL INCOME *	25.1	28.3	1.97	182
MILITARY PAY *	.216	.329	.00	2.12
CIVILIAN PAY *	.194	.270	.00	1.59
PROCUREMENT CONTRACTS *	.546	.916	.00	7.45
R & D CONTRACTS *	.124	.313	.00	2.54
SERVICE CONTRACTS *	.147	.250	.00	1.60
CONSTRUCTION CONTRACTS *	.018	.029	.00	.20
STATE HEALTH EDUC. & HIGH. *	1.39	1.39	.16	8.93
STATE WELFARE *	.493	.748	.02	4.56
MANUFACTURING EMPLOYMENT	.080	.032	.01	.14
PERSONAL INCOME TAX	.016	.011	.00	.04
CORPORATE INCOME TAX	.008	.004	.00	.02
POPULATION DENSITY **	.159	.224	.00	1.01
MANUFACTURING WAGE ***	3.96	.569	2.89	5.45

* - BILLIONS OF 1972 DOLLARS
** - POPULATION(x1000) PER SQUARE MILE
*** - 1972 DOLLARS PER HOUR

TABLE 6

DESCRIPTION OF VARIABLES: WELFARE GROWTH MODEL

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM
PER CAPITA PERSONAL INCOME *	5060	723.6	3433	7796
PER CAPITA MILITARY PAY *	51.0	41.4	.97	245.3
PER CAPITA CIVILIAN PAY *	42.1	38.5	4.94	206.6
PER CAPITA PROCUREMENT CONT. *	97.9	105.9	2.52	752.4
PER CAPITA R & D CONT. *	18.2	26.9	.00	147.3
PER CAPITA SERVICE CONT. *	27.1	25.0	.27	190.6
PER CAPITA CONSTRUCT. CONT. *	4.5	5.3	.00	44.6
PER CAPITA STATE HEALTH EDUC. & HIGH. *	314.5	61.8	177	582.2
PER CAPITA STATE WELFARE *	88.6	35.7	26	207.3
MANUFACTURING EMPLOYMENT	.080	.032	.01	.14
PERSONAL INCOME TAX	.016	.011	.00	.04
CORPORATE INCOME TAX	.008	.004	.00	.02
POPULATION DENSITY **	.159	.224	.00	1.01
MANUFACTURING WAGE ***	3.96	.569	2.89	5.45

* - 1972 DOLLARS PER PERSON
** - POPULATION(x1000) PER SQUARE MILE
*** - 1972 DOLLARS PER HOUR

explanatory variables, in addition to being associated with changes in the dependent variable. A rule of thumb is that a coefficient of correlation greater than .7 between two independent variables is indicative of multicollinearity [Ref. 35:p. 18]. Correlation shows association of variables but not causality. In this analysis state spending for health, education, and highways is highly correlated with state spending on welfare. This is expected because as growth occurs all public expenditures tend to increase together. The same relationship would be expected between military spending variables. This is not an unusual occurrence in time series data where variables move together over time. The result of multicollinearity will be an increase in the standard errors of the regression parameters. [Ref. 36:p. 68]

Table 8 is the correlation matrix for the welfare growth model. Correlation is not present in the independent variables to the extent it is in the volume growth model. There is a surprising significant negative correlation between the dependent variable and per capita state expenditures for health, education and highways. These simple correlation coefficients can be misleading however, since other factors are not held constant. This is the purpose of the multivariate regression model.

Using the model and data just specified, ordinary least square regression was used to calculate explanatory variable

TABLE 7

PEARSON CORRELATION COEFFICIENTS FOR VOLUME GROWTH MODEL

(PERSONAL INCOME IS THE DEPENDENT VARIABLE)

	PERS INC	MIL PAY	CIV PAY	PROC CONT	R&D CONT	SERV CONT	CONS CONT
PERSONAL INCOME	1.000	.6531 **	.7067 **	.8391 **	.7388 **	.8245 **	.5888 **
MILITARY PAY	.6531 **	1.000	.8655 **	.6883 **	.7149 **	.7925 **	.8115 **
CIVILIAN PAY	.7067 **	.8655 **	1.000	.7002 **	.7396 **	.8240 **	.7684 **
PROCUREMENT CONTRACTS	.8391 **	.6883 **	.7002 **	1.000	.8532 **	.8579 **	.6441 **
R & D CONTRACTS	.7388 **	.7149 **	.7396 **	.8532 **	1.000	.8255 **	.7042 **
SERVICE CONTRACTS	.8245 **	.7925 **	.8240 **	.8579 **	.8255 **	1.000	.7004 **
CONSTRUCTION CONTRACTS	.5888 **	.8115 **	.7684 **	.6441 **	.7042 **	.7004 **	1.000
STATE HEALTH EDUC. & HIGH.	.9818 **	.6879 **	.7241 **	.8145 **	.7289 **	.8196 **	.6256 **
STATE WELFARE	.9359 **	.5368 **	.6315 **	.7990 **	.7673 **	.8019 **	.5220 **
MANUFACTURING EMPLOYMENT	.1737 **	-.015	.0432	.1368 *	.0247	.0153	-.031
PERSONAL INCOME TAX	.1104 *	-.045	.0229	.0559	.0954	.1294 *	-.076
CORPORATE INCOME TAX	.2325 **	.0104	.0761	.1926 **	.2161 **	.1830 **	.0181
POPULATION DENSITY	.2385 **	-.040	.0965	.2215 **	.1667 **	.1885 **	-.046
MANUFACTURING WAGE	.2408 **	-.105	.0261	.1345 *	.1380 *	.0305	-.029

* - SIGNIFICANCE LESS THEN OR EQUAL TO .01

** - SIGNIFICANCE LESS THEN OR EQUAL TO .001

TABLE 7 (CONTINUED)
PEARSON CORRELATION COEFFICIENTS

	STATE HE&H	STATE WELF	MFGT EMPL	INC TAX	COR TAX	POP DEN	MFGT WAGE
PERSONAL INCOME	.9818 **	.9359 **	.1737 **	.1104 *	.2325 **	.2385 **	.2408 **
MILITARY PAY	.6879 **	.5368 **	-.015	-.045	.0104	-.040	-.105
CIVILIAN PAY	.7241 **	.6315 **	.0432	.0229	.0761	.0965	.0261
PROCUREMENT CONTRACTS	.8145 **	.7990 **	.1368 *	.0559	.1926 **	.2215 **	.1345 *
R & D CONTRACTS	.7289 **	.7673 **	.0247	.0954	.2161 **	.1667 **	.1380 *
SERVICE CONTRACTS	.8196 **	.8019 **	.0153	.1294 *	.1830 **	.1885 **	.0305
CONSTRUCTION CONTRACTS	.6256 **	.5220 **	-.031	-.076	.0181	-.046	-.029
STATE HEALTH EDUC. & HIGH.	1.000	.9282 **	.1628 **	.1248 *	.2255 **	.1502 **	.2417 **
STATE WELFARE	.9282 **	1.000	.1793 **	.2415 **	.3744 **	.2377 **	.2519 **
MANUFACTURING EMPLOYMENT	.1628 **	.1793 **	1.000	.3055 **	.4161 **	.4649 **	-.102
PERSONAL INCOME TAX	.1248 *	.2415 **	.3055 **	1.000	.4820 **	.1441 **	.1681 **
CORPORATE INCOME TAX	.2255 **	.3744 **	.4161 **	.4820 **	1.000	.3137 **	-.016
POPULATION DENSITY	.1502 **	.2377 **	.4649 **	.1441 **	.3137 **	1.000	-.046
MANUFACTURING WAGE	.2417 **	.2519 **	-.102	.1681 **	-.016	-.046	1.000

* - SIGNIFICANCE LESS THEN OR EQUAL TO .01
** - SIGNIFICANCE LESS THEN OR EQUAL TO .001

TABLE 8

PEARSON CORRELATION COEFFICIENTS FOR WELFARE GROWTH MODEL

(PER CAPITA INCOME IS THE DEPENDENT VARIABLE)

		PERS INC	MIL PAY	CIV PAY	PROC CONT	R&D CONT	SERV CONT	CONS CONT
		++++++++ PER			CAPITA			++++++++
+	PERSONAL	1.000	-.087	-.048	.3936	.4169	.3149	-.073
+	INCOME				**	**	**	
P	MILITARY	-.087	1.000	.5229	-.112	.0677	.4759	.4392
	PAY			**	*		**	**
E								
	CIVILIAN	-.048	.5229	1.000	.0552	.3039	.5432	.3621
R	PAY		**			**	**	**
	PROCUREMENT	.3936	-.112	.0552	1.000	.4112	.3941	-.042
	CONTRACTS	**	*			**	**	
C								
	R & D	.4169	.0677	.3039	.4112	1.000	.4173	.1350
A	CONTRACTS	**		**	**		**	*
P	SERVICE	.3149	.4759	.5432	.3941	.4173	1.000	.2502
	CONTRACTS	**	**	**	**	**		**
I								
	CONSTRUCTION	-.073	.4392	.3621	-.042	.1350	.2502	1.000
T	CONTRACTS		**	**		*	**	
A	STATE HEALTH	-.130	.2558	.0630	-.299	-.072	-.036	.2054
	EDUC. & HIGH.	*	**		**			**
+								
+	STATE	.4067	-.397	-.162	.2386	.2981	.0838	-.212
+	WELFARE	**	**	**	**	**		**
	MANUFACTURING	.0625	-.322	-.067	.3189	.0191	-.060	-.260
	EMPLOYMENT		**		**			**
	PERSONAL	.0786	-.208	-.053	-.054	.0180	.0293	-.257
	INCOME TAX		**					**
	CORPORATE	.0866	-.213	-.127	.1316	.0268	.0262	-.241
	INCOME TAX		**	*	*			**
	POPULATION	.4663	-.236	.0129	.3377	.2810	.2231	-.179
	DENSITY	**	**		**	**	**	**
	MANUFACTURING	.4222	-.366	-.239	-.028	.1326	-.168	-.175
	WAGE	**	**	**		*	**	**

* - SIGNIFICANCE LESS THEN OR EQUAL TO .01

** - SIGNIFICANCE LESS THEN OR EQUAL TO .001

TABLE 8 (CONTINUED)

PEARSON CORRELATION COEFFICIENTS

		PER CAPITA STATE HE&H	PER CAPITA STATE WELF	MFGT EMPL	INC TAX	COR TAX	POP DEN	MFGT WAGE
+	PERSONAL	-.130	.4067	.0625	.0786	.0866	.4663	.4222
+	INCOME	*	**				**	**
P	MILITARY	.2558	-.397	-.322	-.208	-.213	-.236	-.366
	PAY	**	**	**	**	**	**	**
E								
	CIVILIAN	.0630	-.162	-.067	-.053	-.127	.0129	-.239
R	PAY		**			*		**
	PROCUREMENT	-.299	.2386	.3189	-.054	.1316	.3377	-.028
	CONTRACTS	**	**	**		*	**	
C								
	R & D	-.072	.2981	.0191	.0180	.0268	.2810	.1326
A	CONTRACTS		**				**	*
P	SERVICE	-.036	.0838	-.060	.0293	.0262	.2231	-.168
	CONTRACTS						**	**
I								
	CONSTRUCTION	.2054	-.212	-.260	-.257	-.241	-.179	-.175
T	CONTRACTS	**	**	**	**	**	**	**
A	STATE HEALTH	1.000	-.177	-.474	.0745	-.164	-.347	.1488
	EDUC. & HIGH.		**	**		**	**	**
+								
+	STATE	-.177	1.000	.3906	.4492	.5354	.5162	.2122
+	WELFARE	**		**	**	**	**	**
	MANUFACTURING	-.474	.3906	1.000	.3055	.4161	.4649	-.102
	EMPLOYMENT	**	**		**	**	**	
	PERSONAL	.0745	.4492	.3055	1.000	.4820	.1441	.1681
	INCOME TAX		**	**		**	**	**
	CORPORATE	-.164	.5354	.4161	.4820	1.000	.3137	-.016
	INCOME TAX	**	**	**	**		**	
	POPULATION	-.347	.5162	.4649	.1441	.3137	1.000	-.046
	DENSITY	**	**	**	**	**		
	MANUFACTURING	.1488	.2122	-.102	.1681	-.016	-.046	1.000
	WAGE	**	**		**			

* - SIGNIFICANCE LESS THEN OR EQUAL TO .01
** - SIGNIFICANCE LESS THEN OR EQUAL TO .001

coefficients. The results of the regression of both the volume and welfare growth models are presented in the next chapter.

V. ANALYSIS OF REGRESSION RESULTS

The explanatory variable coefficients for the model were estimated using ordinary least square regression on the SPSSX Information Analysis System. The computer output of the regression results are presented in Appendix A. The following discussion of results is broken into two sections. The first section discusses the volume variant of the growth model, and the second discusses the welfare variant.

A. VOLUME GROWTH MODEL

Two regressions were estimated initially, one containing the state and year dummy variables, and one without the dummy variables. Ideally the model without the dummy variables is preferred. The use of the dummies is an attempt to adjust for information omitted from the original model. For the state dummies this information might include climate, geography, unionization, and energy price differences relative to other states. The year dummies might represent cyclical trends that impact on all of the states. These dummy variables may explain a significant portion of the error variance. However, since the dummies represent important unknown variables no additional knowledge of what causes state economic growth is gained from their inclusion. Inclusion of the dummy variables also result in a reduction in degrees of freedom from 466 to 410. This means the

statistical power of the growth model will not be as great as if the dummies were not included.

A statistical test was used to determine whether the dummy variables should be included in the model. The test compares the residual sum of squares from the two different models. The model without dummy variables is more restrictive by forcing the intercepts to be equal for all observations independent of state or year. This causes a higher residual sum of squares for that model. If there is a statistically significant decrease in the residual sum of squares when dummy variables are added to the equation, then results based on the dummy variable model are more appropriate.

An F-statistic of 42.5 with 56 degrees of freedom for the numerator and 410 degrees of freedom for the denominator was calculated from the results of the two regression runs. The numerator of the statistic was calculated by dividing the difference in the residual sum of squares between the models by the additional degrees of freedom of the model without dummy variables. The denominator of the F-statistic is the residual sum of squares from the model including dummy variables divided by the degrees of freedom of that model. The null hypothesis is that the model without the dummy variables is correct. The critical value for a significance level of .005 is 1.87. Based on the calculated F-statistic the null hypothesis is strongly rejected and the model with

the dummy variables should be used. [Ref. 36:p. 205] This means that there is significant variation in the dependent variable that is explained by the dummy variables.

Because of the outcome of the above test the results presented in this section are based on the regression coefficients calculated when the dummy variables were included in the growth model. The summary of the coefficients for the volume growth variables is presented in Table 9. The t-ratios shown test the null hypothesis that the regression coefficient for an explanatory variable is zero or, in other words, that the variable has no impact on total personal income. Significance is the probability that the null hypothesis is true. For example, manufacturing wage has a 90 percent chance of having no impact on personal income. This result indicates this explanatory variable is unimportant in growth of a state.

Defense contracts, on the other hand, are all significant to a state's growth measured by total personal income. The coefficients of the defense contract variables do give a relative idea of the impact that each type of contract has on state growth. The higher t-ratios mean an increase in confidence that the impact indicated by the coefficient occurred. The elasticity column in Table 9 allows a comparison of the impact of the different explanatory variables. Elasticities, since they are unit free, show how responsive the dependent variable is to a change in an

TABLE 9
VOLUME GROWTH MODEL
REGRESSION COEFFICIENT ESTIMATES
(Dependent Variable is Total Personal Income)

VARIABLE	COEFFICIENT	T-RATIO	SIGNIFICANCE	ELASTICITY
MILITARY PAY	-1.442	-.772	.44	-.012
CIVILIAN PAY	-18.49	-4.05	.00	-.143
PROCUREMENT CONTRACTS	4.694	11.2	.00	.102
R & D CONTRACTS	5.265	3.90	.00	.026
SERVICE CONTRACTS	8.939	5.21	.00	.052
CONSTRUCTION CONTRACTS	19.54	3.25	.00	.014
STATE HEALTH EDUC. & HIGH.	6.041	9.24	.00	.335
STATE WELFARE	4.319	3.43	.00	.085
MANUFACTURING EMPLOYMENT	-32.28	-1.50	.13	-.103
PERSONAL INCOME TAX	-84.88	-1.81	.07	-.054
CORPORATE INCOME TAX	-113.6	-1.91	.06	-.036
POPULATION DENSITY	220.7	8.04	.00	1.40
MANUFACTURING WAGE	-.1175	-.127	.90	-.162

(Complete regression results are in appendix A)

independent variable. The value shown is the percentage change expected in personal income given a one percent change in the explanatory variable. Personal income is relatively inelastic with respect to all defense spending variables, with procurement contracts having the largest impact.

The results of the civilian payroll explanatory variable were unexpected. Not only does the model indicate that civilian pay has a negative effect on personal income growth, but the coefficient and t-ratio are relatively high. This means that as the Department of Defense increased civilian pay (either through raises or increased employment) states grew slower then if pay had not been increased. The reason for this result is unclear. Possibly defense hiring of civilians pulled employees away from higher paying jobs in a state. This would assume that civilians were drawn from a productive employment pool and not from among people who would otherwise be unemployed or working at menial tasks. Given the general skills required for defense civilian employees this is not an unreasonable assumption. In the Department of Defense unskilled or low skilled jobs tend to be performed by military members.

The military payroll result was not unexpected. While the coefficient is negative, it is relatively insignificant. As discussed in Chapter II military members tend to buy from military commissaries and exchanges. Often food and lodging is provided on base. Most members do not even pay state

income taxes in the state where they are located. But these military members do consume state public goods. They use public schools and state highways. All the services available to a full time resident of the state are usually available to military members stationed in the state. All of this could be expected to cause military payrolls to have an insignificant impact on state economic growth.

State expenditures and taxation variables had the expected results. Both state spending for health, highways and education and expenditures for welfare have a positive and significant effect on state growth. The welfare result is in part due to using personal income as the proxy for state economic growth. These expenditures result in people who otherwise may have little or no income having an income and contributing to state growth. The adverse side of these transfer payments would be the money removed from the economy to pay for them. This is reflected in the negative (and significant at the 10 percent level) tax proxy coefficients. Determination of whether a state grew faster or slower due to taxation and how the collected revenues are spent, cannot be made with this model. The tax variables are proxies and their coefficients cannot be directly related to the expenditure variables, due to the different dimensions involved (expenditures are in dollars while tax proxies are dimensionless). Comparison of the elasticities indicate that

the gains in personal income due to increased spending have offset the losses due to increased taxation.

Manufacturing over the last decade has declined in the United States. Those states in the traditional manufacturing belt have had slower economic growth due to the heavy dependence of the state economies on manufacturing. This result is reflected in the manufacturing employment explanatory variable. While not highly significant (only at the 13 percent level), the negative coefficient indicates that the more dependent a state was on manufacturing the slower the growth in total personal income. The average manufacturing wage, while having a negative coefficient, was insignificant.

Population density was a highly significant variable. Its coefficient, again due to different dimensions, is not directly comparable to the other explanatory variables, but the t-ratio indicates that states with a high population density grew faster. In fact, this is the only explanatory variable that had an elasticity greater than one--meaning personal income is very responsive to a change in population density. Population density is often referred to as a proxy for markets. The greater the density the greater the demand for goods and the supply of labor. Both factors would fuel state economic growth.

B. WELFARE GROWTH MODEL

The statistical test conducted for the previous model was also calculated for the welfare model to determine if the dummy variables should be used. The calculated F-statistic was 70.6 with 56 degrees of freedom in the numerator and 410 degrees of freedom in the denominator. Again there is highly significant statistical evidence that the model should include the dummy variables. The complete computer results, both with and without state and year dummy variables, appear in Appendix A. The regression results for the model with dummy variables are presented in Table 10, along with the elasticities.

Defense spending for all categories had a positive effect on per capita income growth over the last decade. But only spending for procurement contracts and research and development contracts were highly significant. So the more dollars spent per state resident on these two types of defense contracts the more statistically significant the increase in state welfare as measured by per capita income. This could be partly due to the high technology involved in the majority of procurement contracts and in all research and development contracts. People employed for this work would tend to be relatively highly paid individuals. This could also be expected to be true of suppliers to the initial contractors. Per capita income was also relatively inelastic with respect to defense spending.

TABLE 10
WELFARE GROWTH MODEL
REGRESSION COEFFICIENT ESTIMATES
(Dependent Variable is Per Capita Income)

VARIABLE	COEFFICIENT	T-RATIO	SIGNIFICANCE	ELASTICITY
PER CAPITA MILITARY PAY	1.220	1.36	.17	.012
PER CAPITA CIVILIAN PAY	2.220	1.52	.13	.018
PER CAPITA PROCUREMENT CONT.	.7808	3.62	.00	.015
PER CAPITA R & D CONT.	2.781	3.30	.00	.010
PER CAPITA SERVICE CONT.	.8847	1.48	.14	.005
PER CAPITA CONSTRUCT. CONT.	2.740	1.52	.13	.002
PER CAP. STATE HLTH ED. & HGH.	-.6616	-1.71	.09	-.041
PER CAPITA STATE WELFARE	1.787	1.77	.08	.031
MANUFACTURING EMPLOYMENT	9313	4.66	.00	.147
PERSONAL INCOME TAX	-8284	-1.94	.05	-.026
CORPORATE INCOME TAX	-11720	-2.20	.03	-.019
POPULATION DENSITY	21200	9.32	.00	.666
MANUFACTURING WAGE	286.0	3.38	.00	.224

(Complete regression results are in appendix A)

The per capita state spending results do contain a bit of a surprise. The results indicate (at a 9 percent significance level) that state spending for health, education, and highways has a negative impact on the individual welfare of the state's population. The correlation coefficient between state spending for health, highway, and education and per capita income is significantly negative. The reason for this is unknown.

The positive influence of state welfare spending could be expected. Typically, welfare expenditures try to maintain an income level for poorer members of the state at or above a poverty level. This would act to increase the state's overall per capita income level.

Both tax proxies have significant negative effects on state per capita income growth. These variables represent a reduction in disposable income for individuals, either through less pay or decreased dividends. This would be expected to slow growth. Again, since these are proxy rates, and welfare is an expenditure variable, a comparison of these coefficients does not allow an evaluation to be made on a "spreading the wealth" policy. The elasticities of the variables do indicate that per capita income has increased when welfare payments and taxes have both increased.

Manufacturing employment had a positive significant effect on per capita income. Even while manufacturing regions have not grown as fast as the nation, per capita income growth has

kept pace. A possible reason for this is that high union concentrations in these areas has maintained wages despite the overall economic decline. The positive, significant coefficient for average manufacturing wage rate supports this idea. Additionally, as manufacturing has declined, large out migrations of workers has occurred. States like Indiana and Michigan have had a decline in total population during the period studied. Since per capita income is a function of both total personal income and population, these states have not seen a large relative decline in per capita income. This means workers leaving the state, on the average, earn less than those that remain. This could be the primary reason for their decision to relocate.

Population density, again serving as a market proxy, had a positive influence on per capita income growth. The reasons for this are expected to be the same as the volume growth model. More demand for goods and services and a higher supply of labor would contribute to greater economic activity. Additionally, those states with a low population density, such as Montana and Wyoming, tend to have agrarian based economies. The average person working in agriculture tends to have a lower income than those employed elsewhere.

C. AUTOCORRELATION

One assumption in regression analysis is that observations are drawn independently. Ideally an observation one year will not be related to the next year's observation.

This is not a realistic expectation for the data in the growth models. Expenditures in 1976 tend to be a good predictor of expenditures in 1977 for a given state. One common measure of autocorrelation is the Durbin-Watson statistic.

For both the volume growth and welfare growth models the Durbin-Watson statistics indicate autocorrelation is present. The year dummy variables partly help to correct this problem. The volume growth model goes from a Durbin-Watson statistic of .567 to 1.12 when the dummy variables are added. The welfare growth model does not improve as much, going from .513 to .957 with the dummy variables. However, even with the improvement autocorrelation is still occurring.

Autocorrelation tends to cause distortion in the estimates of the standard errors of the regression coefficients. This in turn causes a decreased confidence in the significance of the explanatory variable coefficient. [Ref. 35:p. 10] Other than being aware of the problem and the effect on the calculated t-ratios, no other action was taken.

VI. CONCLUSION

During the last decade Defense spending has mostly had a positive influence on state economic growth. Results from the linear regression models presented in the preceding chapter showed that all types of defense contracts had a significant positive influence on economic growth as measured by growth in total personal income. Department of Defense spending for civilian pay, however, did have a negative influence on personal income, whereas military pay had an insignificant (negative) impact. Only spending on two types of contracts (procurement, and research and development) had a significant positive impact on state welfare economic growth, as measured by per capita income. The other types of defense spending seemed to have a positive influence, but not at a ten percent level of significance.

The results of this thesis are interesting from a policy viewpoint. In the past, state policies have attempted to influence Department of Defense decisions to increase defense spending in their state, expecting this increased spending to stimulate state growth, a viewpoint supported by this thesis. But elected officials must now assess the impact cuts in defense spending will have on their states.

The issue facing the Department of Defense, and the entire Federal Government, is the renewed Balanced Budget and Emergency Deficit Control Act (Gramm-Rudman). Present

forecasts are that defense spending will have to take an $11.5 billion cut in 1988 [Ref. 37]. This figure is DOD's fifty percent share of the cuts needed to achieve the federal deficit target of $144 billion. To give an idea of how the thesis results could be used, an analysis was conducted of how the possible cuts in defense spending forced by this Act would impact state economic growth.

Originally the cuts in DOD spending were to be spread equally over all military accounts resulting in a 6.3 percent reduction in each account. But President Reagan has committed to exempting military personnel accounts from taking any cuts. This will necessitate deeper cuts, if spread equally about 10.5 percent, in other categories of spending. Department of Defense comptroller, Robert Helm, recently gave the most likely scenario for how cuts will be made: operations and maintenance accounts 10 percent; procurement 16 percent; research and development 11 percent; and military construction 11.7 percent. [Ref. 37]

The model for personal income growth was used to calculate the impact of these three possible ways of making defense cuts. To do this several assumptions were made. First, the cuts would be spread proportional to the volume of defense spending among the states. Second, since the model could not be used to predict the affect of cuts for 1988, because most explanatory variables are unknown, the model was used to show the impact these deficit reduction cuts would

have had on 1985 personal income if made in that year. This assumes the impacts would remain the same. Third, all explanatory variables were assumed to remain constant, other than those for defense spending. The results of the spending cuts on personal income are summarized in Appendix B.

Total personal income for the United States was found to be reduced 0.7 percent with the across the board 6.3 percent reduction in spending. However, exempting military pay from cuts made the matter worse. With the cuts evenly spread over the remaining accounts personal income was reduced 1.1 percent, and with DOD's predicted uneven distribution of cuts personal income was reduced 1.8 percent. Individually, some states, such as Oregon, showed little change in personal income no matter how the cuts were made. Other states, however, suffered severely when the policy was changed from all accounts being cut equally to the uneven distribution of cuts exempting military pay. Connecticut went from a 2.6 percent reduction in personal income to a 6.3 percent reduction. Missouri, similarly, went from 2.3 percent reduction to 6.1 percent reduction in personal income. This indicates these states should be very concerned with the policy of exempting military pay from the Deficit Control Act reductions.

A caveat to this analysis should be made. The thesis results are for an average state based on historical data. There is no ability to predict the future outcome based on

the model results. This is compounded by significant statistical problems in the model, such as multicollinearity and autocorrelation. The suggested impact of the defense cuts are provided as a look at what the regression results would indicate. Also, other effects, such as a decline in interest rates that will probably occur with deficit reduction are not included here.

In summary, there is statistical evidence of positive contribution to state growth of defense spending on contracts. Elected federal officials should be aware of this significant contribution and actively pursue policies that will increase the viability of defense businesses in their states. As defense spending cuts become more of a reality, individual states must assess the impact on their future economic growth.

Areas for possible future study include:

1. Study of methodology for reducing autocorrelation such as the Cochrane-Orcutt procedure or the Hildreth-Lu procedure. Applying this to the thesis model would increase the confidence in the regression coefficients. Discussion of these two methods in particular can be found in Reference 36.
2. Specific study of area multiplier effects of defense spending should be undertaken. This will be especially crucial as defense cutbacks begin to take place. A

study similar to the one previously cited for Wichita, Kansas could provide such information [Ref. 2].

3. An interesting relationship was noticed between two different studies cited in this thesis. Menegakis in Reference 32 did a discriminate analysis to determine if high military spending states could be identified by social and economic parameters. His results were inconclusive. However from comparison of his misclassified states and the Net Defense Department Spending per worker calculated by the Council on Economic Priorities, shown in Table 3, there seems to be some relationship between the parameters and this method of determining relative defense spending. A combination of these two studies with current data could be useful.

APPENDIX A

COMPUTER PRINTOUTS

This Appendix contains the regression results for the thesis. First the models with personal income as the dependent variable are presented. Versions with and without state and year dummy variables are included, along with the results for a model where all Department of Defense expenditures were combined into one explanatory variable. Next, results for the models with per capita income as the dependent variable are presented. The coefficients of the explanatory variables represent the average values for all states examined. To determine results for a particular state in a given year for a model with dummy variables the appropriate state and year dummy variable results must be included in the equation. The base state and year is Wyoming in 1985 with no dummy variable needed for calculations involving that state in that year.

VARIABLE LIST

MILPAY = DOD Military Pay

CIVPAY = DOD Civilian Pay

PROCCON = DOD Procurement Contracts

RDCON = DOD Research & Development Contracts

SERVCON = DOD Service Contracts

CONSCON = DOD Construction Contracts

STWEL = State Expenditures for Welfare

STHEH = State Expenditures for Health, Education and Highways

INCTXPY = Personal Income Tax Proxy

CORTXPY = Corporate Income Tax Proxy

MANEMPAG = Manufacturing Employment

MANWAGE = Average Manufacturing Wage

POPDEN = Population Density

DODTOTAL = Combined DOD Payrolls and Contracts

PCMILPAY = Per Capita DOD Military Pay

PCCIVPAY = Per Capita DOD Civilian Pay

PCPROCON = Per Capita DOD Procurement Contracts

PCRDCON = Per Capita DOD Research & Development Contracts

PCSRVCON = Per Capita DOD Service Contracts

PCCSTCON = Per Capita DOD Construction Contracts

PCSTWEL = Per Capita State Expenditures for Welfare

PCSTHEH = Per Capita State Expenditures for Health, Education and Highways

EQUATION NUMBER 1 DEPENDENT VARIABLE IS PERSONAL INCOME
REGRESSION EQUATION INCLUDES STATE AND YEAR DUMMY VARIABLES

MULTIPLE R	.99848
R SQUARE	.99697
ADJUSTED R SQUARE	.99645
STANDARD ERROR	1.68763

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARES
REGRESSION	69	383602.17846	5559.45186
RESIDUAL	410	1167.71649	2.84809

F = 1951.99373 SIGNIF F = .0000

DURBIN-WATSON TEST = 1.11830

----------VARIABLES IN THE EQUATION----------

VARIABLE	B	SE B	BETA	T	SIG T
MILPAY	-1.443063	1.866841	-.016757	-.773	.4400
CIVPAY	-18.488124	4.562069	-.176040	-4.053	.0001
PROCCON	4.693809	.418102	.151684	11.226	.0000
RDCON	5.265133	1.350334	.058234	3.899	.0001
SERVCON	8.938893	1.716073	.078850	5.209	.0000
CONSCON	19.539607	6.006884	.019991	3.253	.0012
STWEL	4.318624	1.259695	.114010	3.428	.0007
STHEH	6.040854	.653520	.296570	9.244	.0000
INCTXPY	-84.863304	46.799653	-.031752	-1.813	.0705
CORTXPY	-113.642059	59.421107	-.015913	-1.912	.0565
MANEMPAG	-32.290531	21.505770	-.036224	-1.501	.1340
MANWAGE	-.117706	.923793	-.002362	-.127	.8987
POPDEN	220.807283	27.468449	1.746997	8.039	.0000
(CONSTANT)	2.155234	3.800998		.567	.5710
YEAR DUMMY COEFFICIENTS					
1976	-1.898515	.470554	-.020117	-4.035	.0001
1977	-1.538605	.475794	-.016303	-3.234	.0013
1978	-.851035	.486909	-.009018	-1.748	.0812
1979	-.196657	.492245	-.002084	-.400	.6897
1980	-.410167	.455120	-.004346	-.901	.3680
1981	-.835814	.425344	-.008856	-1.965	.0501
1982	-1.307367	.377207	-.013853	-3.466	.0006
1983	-1.645644	.388087	-.017437	-4.240	.0000
1984	-.430767	.384406	-.004458	-1.095	.2743

EQUATION NUMBER 1 DEPENDENT VARIABLE IS PERSONAL INCOME

STATE DUMMY COEFFICIENTS

VARIABLE	B	SE B	BETA	T	SIG T
AL	-3.006133	2.937603	-.015165	-1.023	.3068
AZ	4.402475	1.443775	.022209	3.049	.0024
AR	-.359349	2.493304	-.001813	-.144	.8855
CA	34.616749	9.459009	.174628	4.474	.0000
CO	7.356050	1.644350	.037108	4.474	.0000
CT	-131.479533	17.249580	-.663463	-7.622	.0000
DE	-59.652816	8.875480	-.300925	-6.721	.0000
FL	-5.567191	4.981542	-.028084	-1.118	.2644
GA	.682080	3.572282	.003441	.191	.8487
ID	3.821357	1.707190	.019277	2.238	.0257
IL	3.515146	5.685810	.017733	.618	.5368
IN	-13.283754	4.429493	-.067011	-2.999	.0029
IA	-.011919	2.260107	-.000060	-.005	.9958
KS	3.914502	1.855118	.019798	2.116	.0350
KY	-7.309680	2.842369	-.036875	-2.572	.0105
LA	-10.906062	2.531580	-.055017	-4.308	.0000
ME	-1.871658	2.439560	-.008442	-.767	.4434
MD	-74.416805	11.733963	-.375404	-6.342	.0000
MA	-143.999791	19.917042	-.726423	-7.230	.0000
MI	-3.672849	4.807844	-.018528	-.764	.4453
MN	3.233221	2.802953	.016310	1.154	.2494
MS	-5.558745	2.475273	-.028042	-2.246	.0253
MO	-3.013642	2.624402	-.015203	-1.148	.2515
MT	3.859459	1.565547	.019469	2.465	.0141
NE	3.961153	1.494643	.019982	2.650	.0084
NV	1.514173	.771639	.007638	1.962	.0504
NH	-47.007776	3.614488	-.070664	-3.875	.0001
NJ	-182.662598	26.797236	-.921462	-6.816	.0000
NM	1.601853	1.272487	.008081	1.259	.2088
NY	-32.596621	10.321478	-.164437	-3.158	.0017
NC	-5.892579	4.437046	-.029726	-1.328	.1849
ND	1.432222	1.239519	.007225	1.155	.2486
OH	-17.486491	7.158217	-.088213	-2.443	.0150
OK	4.713540	1.992319	.023778	2.366	.0185
OR	7.812197	2.486788	.039410	3.141	.0018
PA	-12.658556	7.645236	-.063858	-1.656	.0985
RI	-190.855839	24.832243	-.962794	-7.676	.0000
SC	-7.758701	3.910926	-.039140	-1.984	.0479
SD	.381177	1.054985	.001923	.361	.7181
TN	-10.261805	3.513915	-.051767	-2.920	.0037
TX	33.783829	3.729552	.170426	9.058	.0000
UT	4.982014	1.951881	.025132	2.552	.0111
VT	-6.368565	2.747066	-.032127	-2.318	.0209
VA	.274916	5.854858	.001387	.047	.9626
WA	-2.080361	2.308596	-.010495	-.901	.3680
WV	-11.284319	2.433581	-.056925	-4.637	.0000
WI	.174358	3.539282	.000879	.049	.9607

EQUATION NUMBER 2 DEPENDENT VARIABLE IS PERSONAL INCOME
REGRESSION EQUATION WITHOUT DUMMY VARIABLES

MULTIPLE R	.98963
R SQUARE	.97936
ADJUSTED R SQUARE	.97878
STANDARD ERROR	4.12843

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	13	376827.40792	28986.72369
RESIDUAL	466	7942.48702	17.04396

F = 1700.70322 SIGNIF F = .0000

DURBIN-WATSON TEST = .56684

----------VARIABLES IN THE EQUATION----------

VARIABLE	B	SE B	BETA	T	SIG T
MILPAY	.780307	1.701037	.009067	.459	.6466
CIVPAY	1.706622	1.671685	.013394	.841	.4005
PROCCON	3.571299	.538088	.115409	6.637	.0000
RDCON	-3.729939	1.578318	-.041254	-2.363	.0185
SERVCON	-.995315	2.348428	-.008780	-.424	.6719
CONSCON	-38.127364	12.092331	-.039008	-3.153	.0017
STHEH	15.957741	.588991	.783430	27.093	.0000
STWEL	5.995326	1.106932	.158274	5.416	.0000
INCTXPY	-73.331141	22.601826	-.027437	-3.244	.0013
CORTXPY	-142.811390	63.880172	-.019997	-2.236	.0259
MANEMPAG	-17.561440	8.212321	-.019701	-2.138	.0330
MANWAGE	.374798	.430988	.007520	.890	.3738
POPDEN	10.507932	1.067398	.083137	9.844	.0000
(CONSTANT)	-.558831	1.826007		-.306	.7597

EQUATION 3 DEPENDENT VARIABLE IS PERSONAL INCOME
TOTAL DOD EXPENDITURES AS EXPLANATORY VARIABLE

MULTIPLE R	.99823
R SQUARE	.99646
ADJUSTED R SQUARE	.99591
STANDARD ERROR	1.81273

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARES
REGRESSION	64	383406.21164	5990.72206
RESIDUAL	415	1363.68330	3.28598

F = 1823.11366 SIGNIF F = .0000

DURBIN-WATSON = .95726

----------VARIABLES IN THE EQUATION----------

VARIABLE	B	SE B	BETA	T	SIG T
DODTOTAL	4.543232	.296704	.308656	15.312	.0000
STHEH	7.017868	.657498	.344536	10.674	.0000
STWEL	4.575003	1.295928	.120778	3.530	.0005
INCTXPY	-99.215564	49.663298	-.037122	-1.998	.0464
CORTXPY	-164.367799	62.738601	-.023015	-2.620	.0091
MANEMPAG	-39.238094	23.028280	-.042897	-1.660	.0976
MANWAGE	-1.134074	.967089	-.011754	-1.173	.2417
POPDEN	212.708888	29.403601	1.683002	7.234	.0000
(CONSTANT)	6.119346	3.990211		1.534	.1259
YEAR DUMMY COEFFICIENTS					
1976	-2.443813	.486766	-.025895	-5.021	.0000
1977	-2.154354	.498935	-.022828	-4.318	.0000
1978	-1.485976	.515089	-.015745	-2.885	.0041
1979	-.182304	.522421	-.001932	-.349	.7273
1980	-.539701	.476505	-.005719	-1.133	.2580
1981	-.963148	.444428	-.010206	-2.067	.0308
1982	-1.363800	.393633	-.014450	-3.465	.0006
1983	-1.702323	.409749	-.018144	-4.079	.0000
1984	-.560869	.408772	-.005943	-1.372	.1708

EQUATION NUMBER 3 DEPENDENT VARIABLE IS PERSONAL INCOME

STATE DUMMY COEFFICIENTS

VARIABLE	B	SE B	BETA	T	SIG T
AL	-9.094819	2.889237	-.045880	-3.148	.0018
AZ	2.075129	1.505771	.010468	1.378	.0689
AR	-1.258165	2.660837	-.006347	-.473	.6366
CA	-3.964988	5.779136	-.020002	-.686	.4930
CO	3.738633	1.661641	.018860	2.250	.0550
CT	-128.644627	18.434769	-.633828	-6.816	.0000
DE	-55.733882	9.504245	-.281156	-5.864	.0000
FL	-15.182977	5.091176	-.076592	-2.982	.0030
GA	-8.724902	3.454201	-.044014	-2.526	.0119
ID	4.710608	1.817163	.023763	2.592	.0099
IL	-2.287565	5.931444	-.011540	-.386	.6999
IN	-14.527842	4.670040	-.073287	-3.111	.0020
IA	1.308896	2.410292	.006603	.543	.5874
KS	6.184093	1.984210	.016063	1.605	.1096
KY	-10.633765	3.008886	-.053643	-3.534	.0005
LA	-12.193612	2.685190	-.061512	-.617	.5378
ME	-1.610311	2.611153	-.008123	-.617	.5378
MD	-81.510218	12.350978	-.411187	-6.599	.0000
MA	-139.601618	21.292178	-.704236	-6.556	.0000
MI	-4.861842	5.041406	-.024526	-.964	.3354
MN	3.914582	2.963567	.019748	1.321	.1873
MS	-8.303913	2.599742	-.041890	-3.194	.0015
MO	-6.634277	2.540364	-.033467	-2.612	.0093
MT	5.368113	3.659138	.027080	3.235	.0013
NE	2.458035	1.599920	.017444	2.161	.0312
NV	1.187699	.824549	.005991	1.440	.1505
NH	14.711172	3.861907	-.074212	-3.809	.0002
NJ	-180.423776	28.648008	-.912690	-6.315	.0000
NM	1.554406	1.263263	-.006832	-1.072	.2843
NY	-34.894913	10.614860	-.176031	-3.287	.0011
NC	-12.188881	4.684581	-.061488	-2.602	.0096
ND	1.279770	1.315282	.006254	.943	.3464
OH	-20.999362	7.362381	-.121067	-3.260	.0012
OK	-1.375221	1.807602	-.006937	-.761	.4472
OR	8.979492	2.654984	.045298	3.382	.0008
PA	-23.682412	7.511856	-.119469	-3.153	.0017
RI	-184.178860	26.595630	-.929111	-6.925	.0000
SC	-19.784970	4.125125	-.067522	-3.245	.0013
SD	-.205213	1.126076	.001035	-.182	.8555
TN	-10.995690	3.741125	-.055469	-2.939	.0035
TX	174.032417	24.354247	.870788	5.960	.0000
UT	.600431	1.836865	.003031	.327	.7437
VT	-5.118883	2.934801	-.025823	-1.744	.0819
VA	-26.266798	4.069711	-.132506	-6.454	.0000
WA	8.283651	2.031857	.041788	4.077	.0001
WV	-10.161193	2.601213	-.051259	-3.906	.0001
WI	1.275767	3.773814	.006436	.338	.7355

AD-A188 847 DEPARTMENT OF DEFENSE EXPENDITURE IMPACT ON STATE ECONOMIC GROWTH(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA C E JAMES DEC 87 2/2

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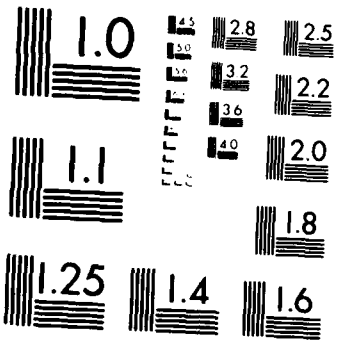

EQUATION NUMBER 4 DEPENDENT VARIABLE IS PER CAPITA INCOME
REGRESSION EQUATION INCLUDES STATE AND YEAR DUMMY VARIABLES

MULTIPLE R	.98079
R SQUARE	.96193
ADJUSTED R SQUARE	.95553
STANDARD ERROR	152.58786

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	69	241229682.57825	3496082.05479
RESIDUAL	410	9546052.46562	23283.05479

F = 150.15566 SIGNIF F = .0000

DURBIN-WATSON TEST = .90250

----------VARIABLES IN THE EQUATION----------

VARIABLE	B	SE B	BETA	T	SIG T
PCMILPAY	1.220218	.898155	.069858	1.359	.1750
PCCIVPAY	2.220552	1.462570	.118284	1.518	.1297
PCPROCON	.780771	.215928	.114285	3.616	.0003
PCRDCON	2.781467	.843968	.103240	3.296	.0011
PCSRVCON	.884669	.597616	.030536	1.480	.1396
PCCSTCON	2.740127	1.799392	.019915	1.523	.1286
PCSTHEH	-.661618	.388156	-.056502	-1.705	.0890
PCSTWEL	1.787451	1.011841	.088294	1.767	.0781
INCTXPY	-8294.408116	4285.739044	-.121562	-1.935	.0536
CORTXPY	-11719.55347	5320.946576	-.064279	-2.203	.0282
MANEMPAG	9313.914457	2000.139467	.409276	4.657	.0000
MANWAGE	285.996085	84.678924	.224766	3.377	.0008
POPDEN	21202.611528	2275.125877	6.570914	9.319	.0000
CONSTANT	4779.689613	363.561049		13.147	.0000
YEAR DUMMY COEFFICIENTS					
1976	-741.903067	48.579189	-.307926	-15.272	.0000
1977	-844.735926	48.750232	-.350607	-17.328	.0000
1978	-709.018352	49.875167	-.294277	-14.216	.0000
1979	-499.201865	48.157948	-.207193	-10.366	.0000
1980	-421.259366	44.009380	-.174843	-9.572	.0000
1981	-440.691010	40.346557	-.082908	-10.923	.0000
1982	-472.936420	34.858724	-.196292	-13.567	.0000
1983	-443.011611	35.666713	-.183871	-12.421	.0000
1984	-258.248763	35.163568	-.107086	-7.344	.0000

EQUATION NUMBER 4 DEPENDENT VARIABLE IS PER CAPITA INCOME

STATE DUMMY VARIABLES

VARIABLE	B	SE B	BETA	T	SIG T
AL	-3618.261409	267.898039	-.714966	-13.506	.0000
AZ	-1612.327428	146.272930	-.318595	-11.023	.0000
AR	-2732.309110	240.783487	-.539903	-11.348	.0000
CA	-6875.482781	417.016132	-.765793	-9.293	.0000
CO	-1164.360118	169.927400	-.230077	-6.852	.0000
CT	-147240.98489	1439.823816	-2.814010	-9.891	.0000
DE	-7220.469878	737.833809	-1.426760	-9.786	.0000
FL	-4553.568681	432.363435	-.702308	-11.399	.0000
GA	-3554.201252	311.806369	-.702308	-11.399	.0000
ID	-1485.407502	171.956722	-.293516	-8.638	.0000
IL	-4925.001275	507.248282	-.973177	-9.709	.0000
IN	-4938.734038	405.690857	-.975891	-12.174	.0000
IA	-2016.389735	229.024068	-.398437	-8.804	.0000
KS	-1368.649501	186.595415	-.270444	-7.335	.0000
KY	-3664.779907	264.369407	-.724158	-13.862	.0000
LA	-3335.515821	239.967601	-.659096	-13.900	.0000
ME	-2645.931547	246.106513	-.522834	-10.751	.0000
MD	-9652.237962	1004.364707	-1.907276	-9.610	.0000
MA	-16475.91464	1687.068075	-3.255630	-9.766	.0000
MI	-4629.162907	449.354701	-.914720	-10.302	.0000
MN	-1710.098191	276.069319	-.337914	-6.194	.0000
MS	-3543.742459	231.876089	-.700240	-15.283	.0000
MO	-3167.159219	255.529631	-.625829	-12.394	.0000
MT	-1183.718925	158.990479	-.233902	-7.445	.0000
NE	-1192.589286	161.255597	-.235655	-7.396	.0000
NV	-144.919068	97.827540	-.028636	-1.481	.1393
NH	-3635.288643	362.420543	-.718337	-10.031	.0000
NJ	-21284.95714	2252.957471	-4.205894	-9.448	.0000
NM	-1493.534271	142.053376	-.295121	-10.514	.0000
NY	-8135.759633	885.825247	-1.607621	-9.186	.0000
NC	-4389.669715	398.716293	-.867330	-11.008	.0000
ND	-731.657356	127.216908	-.144575	-5.751	.0000
OH	-7073.469546	624.294497	-1.397713	-11.330	.0000
Ok	-2031.865434	201.331146	-.401495	-10.092	.0000
OR	-1412.499801	256.985530	-.279109	-5.496	.0000
PA	-6840.544424	641.222330	-1.351687	-10.668	.0000
RI	-20532.59072	2073.011300	-4.057227	-9.905	.0000
SC	-4366.020354	357.470315	-.862723	-12.214	.0000
SD	-1427.892014	123.498714	-.282151	-11.562	.0000
TN	-4303.116915	325.844566	-.850293	-13.206	.0000
TX	-2268.503501	181.011939	-.448255	-12.532	.0000
UT	-2277.827383	274.519160	-.450097	-8.298	.0000
VT	-2672.177654	264.039204	-.528021	-10.120	.0000
VA	-4212.040328	434.569466	-.832297	-9.692	.0000
WA	-272.487856	220.978376	-.538950	-12.343	.0000
WV	-3277.531598	233.867502	-.647638	-14.014	.0000
WI	-2960.982239	350.229209	-.585088	-8.454	.0000

EQUATION NUMBER 5 DEPENDENT VARIABLE IS PER CAPITA INCOME
REGRESSION EQUATION WITHOUT DUMMY VARIABLES

MULTIPLE R	.77121
R SQUARE	.59476
ADJUSTED R SQUARE	.58346
STANDARD ERROR	446.98693

ANALYSIS OF VARIANCE

	DF	SUM OF SQUARES	MEAN SQUARE
REGRESSION	13	149151950.52609	11473269.96355
RESIDUAL	466	101623784.51777	218076.79081

F = 52.61095 SIGNIF F = .0000

DURBIN-WATSON TEST = .51253

----------VARIABLES IN THE EQUATION----------

VARIABLE	B	SE B	BETA	T	SIG T
PCMILPAY	4.325870	.811091	.247656	5.333	.0000
PCCIVPAY	-3.119881	.758667	-.166189	-4.112	.0000
PCPROCON	1.439087	.271139	.210645	5.308	.0000
PCRDCON	2.206376	1.025574	.081894	2.151	.0320
PCSRVCON	4.014654	1.359794	.138576	2.952	.0033
PCCSTCON	-.910515	4.813838	-.006617	-.189	.8501
PCSTHEH	-1.087315	.430330	-.092856	-2.527	.0118
PCSTWEL	3.407189	.917553	.168304	3.713	.0002
INCTXPY	238.333708	2665.363533	.003493	.089	.9288
CORTXPY	-14635.30561	7078.764020	-.080272	-2.067	.0392
MANEMPAG	-3277.021358	969.095524	-.144000	-3.382	.0008
MANWAGE	597.728227	44.647052	.469758	13.388	.0000
POPDEN	1273.760704	128.143773	.394752	9.940	.0000
CONSTANT	2530.445159	248.409647		10.187	.0000

APPENDIX B

DEFICIT REDUCTION ACT IMPACTS

This appendix is a summary of the predicted effects the Balanced Budget and Emergency Deficit Control Act would have caused if the cuts forecasted for 1988 had taken place in 1985. Three policies were tested. Policy one, an across the board 6.3 percent cut. Policy two, a 10.5 percent cut with military pay exempted. Policy three, DOD Comptroller Helm's forecast of how the expected 1988 cuts will take place.

CENSUS REGIONS	% CHANGE IN TOTAL PERSONAL INCOME		
STATE	POLICY 1	POLICY 2	POLICY 3
NEW ENGLAND			
MAINE	-1.3	-2.3	-3.6
NEW HAMPSHIRE	0.0	0.0	-0.7
VERMONT	-0.3	-0.6	-1.0
MASSACHUSETTS	-2.1	-3.5	-4.8
RHODE ISLAND	-0.2	-0.4	-0.7
CONNECTICUT	-2.6	-4.4	-6.3
TOTAL	-1.7	-2.9	-4.2
MIDDLE ATLANTIC			
NEW YORK	-1.1	-1.8	-2.4
NEW JERSEY	-0.3	-0.6	-1.1
PENNSYLVANIA	0.1	0.1	-0.4
TOTAL	-0.6	-1.0	-1.5
EAST NORTH CENTRAL			
OHIO	-0.3	-0.5	-1.2
INDIANA	-0.8	-1.4	-2.2
ILLINOIS	0.0	0.0	-0.1
MICHIGAN	-0.3	-0.6	-1.1
WISCONSIN	-0.4	-0.6	-1.0
TOTAL	-0.2	-0.5	-1.0
WEST NORTH CENTRAL			
MINNESOTA	-1.0	-1.7	-2.5
IOWA	-0.3	-0.6	-0.9
MISSOURI	-2.3	-3.9	-6.1
NORTH DAKOTA	-0.3	-0.9	-1.3
SOUTH DAKOTA	-0.3	-0.6	-0.8
NEBRASKA	0.1	0.0	-0.1
KANSAS	-1.7	-3.0	-3.6
TOTAL	-1.2	-2.1	-3.1
SOUTH ATLANTIC			
DELAWARE	-0.2	-0.4	-0.7
MARYLAND	-0.4	-0.9	-1.7
VIRGINIA	1.1	1.2	0.3
WEST VIRGINIA	0.1	0.2	0.1
NORTH CAROLINA	0.1	-0.2	-0.4
SOUTH CAROLINA	0.9	1.2	0.9
GEORGIA	-0.2	-0.6	-1.5
FLORIDA	-0.5	-1.0	-1.7
TOTAL	0.0	-0.3	-1.0

CENSUS REGIONS	% CHANGE IN TOTAL PERSONAL INCOME		
STATE	POLICY 1	POLICY 2	POLICY 3
EAST SOUTH CENTRAL			
KENTUCKY	0.5	0.7	0.4
TENNESSEE	-0.2	-0.3	-0.5
ALABAMA	0.7	1.0	0.5
MISSISSIPPI	-0.5	-1.1	-2.0
TOTAL	0.2	0.2	-0.2
WEST SOUTH CENTRAL			
ARKANSAS	-0.4	-0.7	-1.4
LOUISIANA	-0.8	-1.4	-2.1
OKLAHOMA	1.0	1.4	1.2
TEXAS	-0.7	-1.3	-2.3
TOTAL	-0.5	-1.0	-1.7
MOUNTAIN			
MONTANA	0.0	-0.1	-0.3
IDAHO	0.2	0.2	0.0
WYOMING	-0.4	-0.8	-1.0
COLORADO	-0.4	-0.8	-1.2
NEW MEXICO	0.4	0.4	0.2
ARIZONA	-0.9	-1.6	-2.5
UTAH	1.7	2.8	2.1
NEVADA	0.0	-0.2	-0.2
TOTAL	-0.1	-0.3	-0.8
PACIFIC			
WASHINGTON	-0.4	-0.9	-1.8
OREGON	0.0	0.0	0.0
CALIFORNIA	-1.3	-2.3	-3.5
TOTAL	-1.1	-2.0	-3.1
UNITED STATES	-0.7	-1.1	-1.8

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